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Analysis of Ratings: A Guide to RMRATE

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$$MR_i = \frac{1}{n} \sum_{j=1}^{n} R_{ij}$$

$$Z_{ij} = (R_{ij} - MR_j) / SDR_j$$

$$SBE_{jc} = (MZ_{jc} - BMZ_j)\,100$$

$$LSR_{ij} = a_j + b_j R_{ij}$$

$$OAR_{ij} = R_{ij} - MR_j$$

$$C_k - S_i = \Phi^{-1}(CP_{ik})\,\alpha$$

Abstract

This report describes RMRATE, a computer program for analyzing rating judgments. RMRATE scales ratings using several scaling procedures, and compares the resulting scale values. The scaling procedures include the median and simple mean, standardized values, scale values based on Thurstone's Law of Categorical Judgment, and regression-based values. RMRATE also computes reliability statistics and analyzes the ratings using principal component analysis techniques to assess variation among judges. RMRATE should be useful to practitioners needing to summarize or analyze rating data, and to researchers interested in comparing and evaluating alternative scaling methods.

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INTRODUCTION

Rating scales provide an efficient and widely used means of recording judgments about many kinds of stimuli (Nunnally 1978). This report describes RMRATE, a computer program for analyzing rating data.

RMRATE is a batch program written in FORTRAN 77 for use with an IBM-compatible personal computer. The program is designed to (1) scale rating data using a battery of scaling procedures; (2) compare the scale values obtained by use of these procedures; (3) evaluate, to a limited extent, whether the assumptions of the scaling procedures are tenable; (4) determine the reliability of the ratings; and (5) evaluate variations among raters.

The scaling procedures of RMRATE are described in detail in a companion paper by Brown and Daniel (1990). That paper and the RMRATE computer program are an outgrowth of an effort that began in the early 1970s to better understand the effects of management on the scenic beauty of forest environments. An important report by Daniel and Boster (1976) introduced the Scenic Beauty Estimation method and made available a computer program for scaling rating data to "SBEs." RMRATE includes SBEs among the scale values it estimates from rating data, and provides a more straightforward output of the results than the earlier program. In addition, RMRATE computes median and mean ratings, standardized scores, and a new scale based on a least squares analysis of the ratings.

While scenic beauty has been the focus of the work that led up to this report, the utility of RMRATE is certainly not limited to measurement of scenic beauty. Rather, RMRATE should be of interest to anyone needing to analyze ratings, no matter what the stimuli.

Use of RMRATE requires an understanding of psychological scaling and experimental design. Readers with no prior knowledge of scaling methods should consult our companion paper (Brown and Daniel 1990) and a basic text on the subject, such as Nunnally (1978) or Torgerson (1958). We suggest that the reader desiring an explicit treatment of experimental design also consult a basic text, such as Cochran and Cox (1957) or Campbell and Stanley (1963).

Brief Description of RMRATE

RMRATE accepts from 5-point to 10-point rating scale data. The program analyzes rating responses by "observers" about "stimuli." The stimuli may be grouped into "conditions." For example, in a study of forest scenic beauty, a condition might be a timber stand, with the stimuli being individual scenes within the stand. Scaled responses about the stimuli are provided for each stimulus and, if applicable, each condition.

If the set of stimuli to be rated is too large to be rated in one session, and it is necessary to obtain ratings in two or more sessions and then combine the ratings from the different sessions, a "baseline" condition may be specified, containing stimuli that are rated in each session. The baseline ratings provide a basis for determining the comparability of the ratings obtained in the different sessions and may allow computation of scale values expressed relative to responses for the baseline stimuli. See Brown and Daniel (1990) for more on baseline adjustments.

RMRATE provides two basic types of information, scale values and statistics. Scale values are computed from the raw ratings according to several scaling procedures, from simple means to standardized (Z) scores to scales based on Thurstone's Law of Categorical Judgment (i.e., SBEs). Statistical information about the ratings includes: (1) indications of the distribution of the ratings (e.g., range, standard deviation, skewness), (2) indications of the correspondence among observers (e.g., reliability coefficients), and (3) analysis of the ratings using principal component analysis.

RMRATE first reproduces the full data set (the raw ratings) and lists the mean and median ratings of each observer and for each stimulus, the standard deviation and range of ratings by each observer and for each stimulus, the skewness of each observer's ratings, and the correlation of each observer's ratings with the mean ratings across all other observers.

The user has the option to remove observers or stimuli from the analysis of the ratings according to several criteria. For example, an observer may be removed if he or she failed to rate more than some specified number of stimuli. If any observers or stimuli are removed, the original table may be reproduced with only the remaining observers and stimuli included.

RMRATE then reports reliabilility statistics indicating the expected correlation of ratings obtained from any two observers, and of group mean ratings obtained from any two observer groups, drawn from the same population as the sample group. The mean of the correlations of each observer's ratings with the mean ratings of the rest of the group of observers in the session is also listed.

Next, the program lists the scale values for each stimulus and each condition according to 10 procedures for scaling rating data. These procedures include the median, mean, standardized (Z) score, and least squares rating, plus several baseline-adjusted procedures including the by-stimulus SBE. Some of the procedures attempt to compensate or adjust for potential problems with rating scale judgments, as described by Brown and Daniel (1990). RMRATE does not attempt to determine the relative merit of these procedures; rather, the procedures are all included in RMRATE, along with statistics indicating the extent to which some of the assumptions

of the scaling procedures appear tenable. The statistics include standard deviation, skewness, kurtosis, and the Anderson-Darling test for goodness-of-fit to a normal distribution. The aim is to provide the user with the means to evaluate the utility of the various scaling procedures for a given application.

RMRATE then reports two indications of the distribution of ratings: the proportion of observers using each possible range of the rating scale and, for each stimulus and condition, the proportion of responses in each of the possible rating categories.

Next, RMRATE compares the results of the different scaling procedures by listing correlation coefficients and producing plots of the scale values for pairs of the scaling procedures. This is done across stimuli and across conditions. For example, the correlation and plot of the mean ratings with the SBEs is listed, first across the stimuli and then, if applicable, across the conditions. The correlation coefficients indicate the degree of linear relationship among the scale values, and the plots help indicate whether a nonlinear relationship exists.

Next, tables are provided of Z-scores and least squares scores for each original rating (for each rating by each observer). These tables may be useful in further analyses performed using other software.

Next, a principal component analysis of the ratings is provided, complete with tables of eigenvalues, component loadings, component scores, and plots of the loadings and scores for selected pairs of components. This analysis can be used to assess the homogeneity of a group's ratings, and to reveal whether subgroups of observers rated the stimuli in consistently different ways.

Finally, a table lists each observer's median and mean rating and by-observer SBEs for each condition, plus indications of the extent to which each observer's ratings are normally distributed.

An additional feature of RMRATE is the option to produce more machine-readable output of the scale values than is available in the standard output tables. This output format is useful if the scale values are to be used as data in further analyses.

Obtaining a Copy of RMRATE

An executable copy of RMRATE can be obtained by writing to the first author, and enclosing a blank formatted 5¼-inch floppy or 3½-inch diskette. That diskette will be loaded with four files: with8087.exe, no8087.exe, sample.exe, and read.me. The first two files install the executable version of RMRATE appropriate to the computer's memory. The first requires a math coprocessor, and the second does not. The third file, sample.exe, installs five files: SAMPLE.DAT, a sample data set identical to that used in this paper to illustrate the program; SAMPLE.RUN, sample input for the data set; SAMPLE.OUT and SAMPLE.SAV, the output files that the sample input and data produce; and SAMPLE.BAT, a batch file for recreating SAMPLE.OUT and SAMPLE.SAV given SAMPLE.RUN and SAMPLE.DAT. Read.me explains how to install the other files.

With modification, RMRATE can be uploaded to run on a mainframe computer. All machine-dependent code is contained in one module of the program, which is easily modified by a FORTRAN programmer. Persons wishing to upload RMRATE to a mainframe can request the source code, again by sending the first author a blank formatted diskette.

STATISTICS OF RMRATE

RMRATE computes two types of information from ratings: scale values and statistics. The scaling procedures are described in detail by Brown and Daniel (1990), and the statistics are described here. Three types of statistical information about a set of ratings are provided: (1) indications of the distribution of the ratings; (2) indications of the correspondence among observers; and (3) analysis of the ratings using principal component analysis to reveal whether subgroups of observers rated the stimuli in consistently different ways.

Distribution of Ratings

Measures that indicate the distribution of ratings by observers and by stimuli are useful in considering whether assumptions of the scaling procedures are tenable. The following measures reported by RMRATE indicate the distribution of each observer's ratings (the distribution of the ratings assigned to the various stimuli by a given observer):

1. Range
2. Standard deviation
3. Skewness
4. The proportion of observers that used each possible range of the rating scale.

The following measures indicate the distribution of ratings assigned by an observer group to each stimulus:

1. Range
2. Standard deviation
3. Proportion of ratings in each rating category
4. Skewness
5. Kurtosis
6. Anderson-Darling statistic.

Range

The range indicates the distance from the lowest rating to the highest rating that a given observer assigned to the stimuli, or that the observers assigned to a given stimulus. For example, if across all stimuli an observer only assigned ratings of 6, 7, and 8, the range is 2; or, if an observer only assigned ratings of 2 and 7, the range is 5. Given a 10-point rating scale, the range may vary from 0 to 9.

Normality

The skewness and kurtosis measures and the Anderson-Darling statistic indicate the degree to which

sets of ratings are normally distributed. The finding that ratings are normally distributed many lend support for acceptance of the assumptions of certain scaling procedures. In terms of stimuli, skewness (Snedecor and Cochran 1980) of the ratings is computed as:

$$Sk_i = \frac{1}{n} \sum_{j=1}^{n} \left[\frac{1}{s_i}(R_{ij} - MR_i)\right]^3 \quad [1]$$

where

Sk_i = skewness of stimulus i
R_{ij} = rating of stimulus i assigned by observer j
MR_i = mean rating assigned to stimulus i
s_i = standard deviation of ratings assigned to stimulus i
n = number of observers.

Skewness measures deviations from symmetry. Sk will be zero when the distribution is completely symmetric (e.g., a bell-shaped curve). A positive value indicates that the ratings are clustered more to the left of the mean, with most of the extreme values to the right. A negative value indicates clustering to the right. The measure, of course, assumes ratings may be used as an interval-level metric.

Kurtosis (Snedecor and Cochran 1980) of the ratings for a stimulus is computed as:

$$K_i = \left\{ \frac{1}{n} \sum_{j=1}^{n} \left[\frac{1}{s_i}(R_{ij} - MR_i)\right]^4 \right\} - 3 \quad [2]$$

where

K_i = kurtosis of stimulus i
R_{ij} = rating of stimulus i assigned by observer j
MR_i = mean rating assigned to stimulus i
s_i = standard deviation of ratings assigned to stimulus i
n = number of observers.

Kurtosis measures the relative peakedness or flatness of the curve defined by the distribution of ratings. A normal distribution will have a kurtosis of zero. If the kurtosis is positive, the distribution is more peaked than is the case with a normal distribution of the same standard deviation; if the kurtosis is negative, the distribution is more flat than that of a normal distribution of the same standard deviation.

The Anderson-Darling statistic can be used to test for goodness-of-fit to a normal distribution. It is one of a class of EDF (empirical distribution function) statistics that includes the Kolmogorov statistic, the Watson statistic, and others (Stephens 1974). Where the population mean and standard deviation are unknown, and must be estimated from the sample, Stephens' (1974) case 3 is appropriate. The Anderson-Darling (A^2) case 3 statistic for the ratings for a given stimulus is computed as:

$$A^2 = -\left\{ \sum_{j=1}^{n} (2j-1) \left[\ln z_j + \ln (1-z_{n+1-j})\right] \right\} / n - n \quad [3]$$

where the ratings are ordered in ascending order and

z_j = cumulative probability of a standard normal distribution of the value w_j
w_j = $(R_j - MR)/SDR$, the standardized score for R_j
R_j = rating by observer j
MR = mean rating for the stimulus
SDR = standard deviation of the ratings for the stimulus
n = number of observers.

The test for normality can be simplified by adjusting A^2 for sample size using the following relationship (Stephens 1974):

$$A^{2*} = A^2 \left(1 + 4 / n - 25 / n^2\right) \quad [4]$$

where

A^{2*} = modified Anderson-Darling case 3 statistic
n = sample size (number of observers).

This modified statistic is then compared with the significance point of the chosen significance level (one-tailed test) (Stephens 1974: table 1.3):

Significance level (%)	**Significance point**
15	0.576
10	0.656
5	0.787
2.5	0.918
1	1.092

The null hypothesis that the population from which the sample of ratings was drawn is normally distributed is rejected if A^{2*} exceeds the cutoff point for the selected significance level. For example, if a sample of ratings yields an A^{2*} of 0.780 for a given stimulus, we would conclude that the distribution of ratings does not differ significantly from a normal distribution, having subjected our test to a 5% chance of a type I error (of rejecting the null hypothesis when it is true).

Correspondence Among Observers

Statistics of correspondence indicate how much confidence one should place in the scores if they are to be used for decisionmaking purposes. As described by Ebel (1951) and Tinsley and Weiss (1975), upon whose work much of this discussion is based, such statistics are easily computed using correlation computations or the results of a standard analysis of variance (ANOVA) of the ratings. Strictly speaking, these statistics assume interval properties for the ratings, but they have been used extensively for evaluating rating scale responses.

Reliability and Agreement

The literature contains a confusing mixture of terms for the different measures of correspondence among observers. We have adopted Tinsley and Weiss' (1975) distinction between "reliability," which focuses on relative differences among observers' ratings (measured by the correlation coefficient), and "agreement," which emphasizes absolute differences among observers'

ratings (measured by the differences between actual ratings).

The choice between reliability and agreement depends on whether or not ratings from one observer or group are going to be compared with those of another observer or group in the course of decisionmaking. For example, considering group mean ratings, the distinction is between decisions that will be based on one set of averaged ratings and decisions requiring absolute comparisons of two or more sets of mean ratings. If such comparisons are necessary for decisionmaking, the absolute values of the ratings are important (i.e., a mean rating of "5" by one observer group must be comparable to a "5" by another observer group). In this case, an "agreement" statistic would be needed. If such comparisons between groups are not necessary for decisionmaking, then the absolute values of the ratings is not important; here, only the relative differences among stimuli matter. In this case, a "reliability" statistic is sufficient. Our position is that absolute comparisons of mean ratings obtained from two separate observer groups, or of individual ratings obtained from separate observers, are generally inappropriate and that, if comparisons between groups are necessary, it is best to use a baseline procedure and scale the ratings to some measure, such as the SBE*, that utilizes the baseline ratings to adjust for differences between groups (see Brown and Daniel 1990). Therefore, we focus on reliability statistics only. See Tinsley and Weiss (1975) for more on agreement statistics.

Choice of the proper reliability coefficient depends on whether it relates to the ratings of individual observers or to the mean ratings of a group of observers. The coefficient for individual observers' ratings will be called the "observer-to-observer" coefficient, while that of observer group mean ratings will be called the "group-to-group" coefficient.

Reliability coefficients are conveniently computed from a two-way ANOVA of the ratings, which partitions the sums of squares into that for stimuli, observers, and observers-by-stimuli interaction. The ANOVA-based equation for the observer-to-observer coefficient (R_{obs}) is:

$$R_{obs} = \frac{MS_s - MS_e}{MS_s + (n-1)MS_e} \qquad [5]$$

where

MS_s = mean square for stimuli
MS_e = mean square for observers-by-stimuli interaction
n = number of observers providing ratings.

Thus, the mean square for observers does not enter the computation of observer-to-observer reliability.

The observer-to-observer reliability coefficient is the expected correlation between any two observers drawn from the relevant population. It indicates the reliability of a single observer's ratings and is of interest if decisions are to be based on one observer's ratings of each stimulus, such as typically occurs in an "expert appraisal" (Daniel and Vining 1983).

Group-to-group reliability (R_{grp}) can be computed from the observer-to-observer coefficient using the Spearman-Brown formula (Nunnally 1978: 211), or from a two-way ANOVA using the following equation:

$$R_{grp} = \frac{MS_s - MS_e}{MS_s} \qquad [6]$$

where MS_s and MS_e have the same meaning as in [5].

Group-to-group reliability indicates the expected correlation between group mean ratings for two groups of observers of the same size as the one at issue sampled from the same population.

Reliability statistics can also be computed for standardized metrics, such as Z-scores. Here, the sum-of-squares for observers will always be 0, and the resulting coefficients are appropriate whether or not the scores of different observers (for R_{obs}) or different observer group means (for R_{grp}) will be compared in decisionmaking, as differences in origin and interval have already been adjusted.

Observer-to-Group Correlation

The observer-to-group correlation reflects the relationship between the ratings of an individual observer and the average ratings assigned to the same stimuli by the rest of the group of observers. The Pearson correlation of each observer's ratings with the mean ratings of the rest of the observers indicates the extent to which any observer is consistent/inconsistent with the group. When a high negative correlation between an observer and the group is obtained, it usually indicates that the observer has misinterpreted the instructions and reversed the rating scale. Of course, a high negative correlation could also result if an observer differed systematically from the other observers in his or her preferences, i.e., if the observer's preferences were opposite those of the group. When a correlation close to 0 is obtained, it may indicate that the observer used an entirely different basis for rating the stimuli than did the rest of the group. Another possibility, however, is that the observer simply responded randomly or used the wrong spaces on the response form.

Principal Component Analysis

Different observers almost never agree perfectly in their ratings of a set of stimuli. Differences among observers' ratings may be attributed to two sources: (1) random variations in perception, preference, or use of the rating scale; and (2) systematic differences in preference or use of the rating scale. When differences among individual observers are due only to random, momentary variation in their responses, it is appropriate to aggregate their ratings into a single scale using one of the methods provided by RMRATE. In the process of combining different observers' ratings, random variations tend to cancel out, leaving a more "pure" measure of the perceptual quality of the stimuli. On the other hand, if differences among observers are due to consistent

differences in their underlying perceptions of the stimuli, it may be misleading to combine their responses into a single scale. If different observers have differing perceptions of the same stimuli, it may be more appropriate to calculate separate aggregate scale values for different segments of the observer population.

Principal component analysis of the inter-rater correlation matrix can be used to assess the homogeneity of a group's ratings, and to reveal the underlying dimensions that characterize variations in observers' responses to the stimuli (Schroeder 1983, 1987). This method explains the intercorrelations among a set of observers in terms of a smaller set of inferred variables called "components." Each component is a weighted sum of observers' ratings, with the weights mathematically defined to capture the maximum amount of observers' variance, subject to the constraint that the components must be uncorrelated among themselves.

The use of principal component analysis to uncover dimensions of preference is illustrated by Schroeder (1987). Variations in preference for urban park environments were characterized by two principal components, reflecting the vegetation density and the development intensity present in the scenes. Different observers attached different weights to each of these two environmental dimensions in making their preference ratings.

Principal component analysis produces three kinds of output: (1) *Eigenvalues* represent the amount of variance in the total data set that can be accounted for by each of the components. A principal component analysis is usually done on standardized scores, so that each observer's variance is equal to 1. The total variance in the data set (i.e., the sum of the individual observer's variances) is therefore equal to the number of observers. The proportion of the total variance accounted for by a component is calculated by dividing the eigenvalue for that component by the total number of observers in the group. (2) *Component loadings* measure how strongly each observer's ratings are related to each of the components. If an observer has a high loading on a particular component, it means that the component is highly correlated with the observer's ratings. (3) *Component scores* show the location of each of the stimuli on each of the dimensions represented by the components.

The first principal component represents the best fit to the group's ratings that can be obtained with a one-dimensional scale. The proportion of variance accounted for by the first component is a measure of the consensus among the observers. For example, if the first component accounts for 60% of the variance in the data set, it means that more than half of the variance in the ratings can be captured in a one-dimensional scale. This scale represents the majority "consensus" about the perceptual quality of the stimuli. The variance associated with the remaining components represents variations from this consensus. The proportion of variance accounted for by the second component indicates how much additional variance can be explained when a second dimension is introduced. The first two components taken together represent the best fit to the data that can be achieved with two perceptual dimensions. Similar interpretations hold for the third and subsequent components.

In many applications of principal component analysis, only components with eigenvalues greater than 1 are considered to be significant, i.e., to represent nonrandom sources of variance in the data. This standard criterion is rather arbitrary, however. To determine whether components beyond the first represent significant variations from the majority viewpoint, at least three criteria should be considered: (1) the size of the components, (2) the number of observers having their strongest loadings on each component, and (3) the interpretability of the components. If a component accounts for substantial variance (e.g., 10% or more), if several observers have their strongest loadings on that component (e.g., 3 or more), and if stimuli with high component scores and stimuli with low component scores differ with respect to some identifiable physical attribute (e.g., tree density), then that component probably represents real (nonrandom) variation in the observers' perceptions.

Other approaches besides principal component analysis can also be used to examine individual differences among raters, for example, cluster analysis and multidimensional scaling. Cluster analysis differs from the approach presented here because it assumes that raters fall into distinct groups and that preferences are relatively homogeneous within the groups. Preference variations, however, might not take this form. For example, preferences could vary continuously along one or more dimensions without there being any clear clusters. It is beyond the scope of this report to provide a complete selection of techniques for analyzing individual differences. If the principal component analysis suggests that there are meaningful variations in preference, the user may gain additional insight by analyzing the data using cluster analysis or other techniques that are available in standard statistical packages.

If principal component analysis is used, it is best not to delete observers who have low correlations with the group average. Such deletion increases the homogeneity of the observer group by removing observers who deviate from the majority consensus, but it is precisely these observers that the principal component analysis is designed to detect. Therefore, deletion of observers defeats the purpose of the principal component analysis option, and the two should not be used together.

USER'S GUIDE TO RMRATE

RMRATE requires 560K bytes of random access memory (RAM) to execute, as would typically be available on a computer with 640K bytes of RAM. Upon special request to the authors, a copy that will run in less memory can be made available, but it should be noted that sample sizes that can be analyzed with such a version are also smaller.[2]

[2]RMRATE has also been successfully compiled and run under OS/2, removing the 640K barrier imposed by DOS and making expanded memory available for larger sample sizes.

Regardless of the RAM requirements, two versions of RMRATE are available. One utilizes a math coprocessor and will only run on a computer with a coprocessor. The other does not utilize a coprocessor. It will run on a computer that has a coprocessor, but will of course run more slowly than the coprocessor version. Both versions are supplied to the user.

RMRATE accommodates the maximum number of observers and stimuli that memory allows. If the data set is too large, a table is printed of possible combinations of observers and stimuli that can be accommodated and the run is terminated.

The principal component analysis requires more memory than the other analyses. If memory is sufficient to accommodate the data set for all analyses except the principal component analysis, the user can select a subset of the observers to be included in the principal component analysis, or a subset of the observers is randomly selected for this analysis and the number of observers included in the analysis is noted.

RMRATE requires two sets of input: data (the ratings to be analyzed) and program control information. The data should be in a separate file, such as that depicted in appendix A. The control information can be entered directly from the keyboard, but a preferred way is to prepare a control file using an editor, and enter that file to begin the run. Appendix B gives an example of a control file for analyzing the data in appendix A. On a PC, the control file could be entered into RMRATE using the DOS redirection feature (<) on the command line. For example, if the control file were called SAMPLE.RUN, the program would be started by entering RMRATE < SAMPLE.RUN.

RMRATE output is organized into 19 displays, which are individually selected by the user. On a PC, the requested output will simply be presented on the monitor unless the user intervenes. Of course, output to the monitor can be simultaneously printed using the DOS "Control Print Screen." In most cases, however, the best option is to redirect the output to a file, which can then be accessed for viewing or printing. On a PC, the output can be redirected to a file by using the DOS redirection feature (>) on the command line. To continue with the above example, if the output file were called SAMPLE.OUT, the command line would be RMRATE < SAMPLE.RUN > SAMPLE.OUT. Appendixes C and D contain the RMRATE output that the data and input parameters in appendixes A and B would produce.

Input

Seventeen lines (or sets of lines) of program control information are required. Each line is described below. The reader can compare the control information in appendix B with the data in appendix A to see an example of how a control file might be arranged. Detailed instructions for preparing a control file, including column specifications, are given in the "Input Parameters" listing at the end of this section. Unless noted otherwise, the examples in the "Input Parameters" listing are identical to the sample runstream of appendix B.

Line lengths are limited to 80 characters. Most of the information required on each of the 17 lines can be easily contained within 80 characters; some, however, may require more than 80 characters and, thus, will require more than one line. Numeric input should be right-justified within the specified column widths; alphanumeric input should be left-justified.

Line 1. Title.—Enter a title; it will appear on each page of output, and can be used to identify the run, data set, and other pertinent information. Date and time are also provided by the program, to distinguish among runs with the same title.

Line 2. Size of data set.—Enter the numbers of observers and stimuli. RMRATE will calculate the amount of computer memory required to process the user's data set. If the data set is too large for the principal component analysis portion of RMRATE, but not too large for other portions of the program, the output will reveal that the maximum number of observers to be included in the principal component analysis is less than the total number of observers. Further, if the data set is even too large for other analyses, an error message will be printed along with a table of possible combinations of reduced numbers of observers/stimuli that will fit in the program's memory, and the run will be terminated.

Line 3. Input option.—The data may be entered by observer or by stimulus. Leaving this line blank indicates that the case for analysis is an observer—that an observer's ratings for all stimuli are read in before proceeding to another observer. Entering a 1 indicates that the case for analysis is a stimulus—that all observers' ratings for a single stimulus are read in before proceeding to another stimulus. Typically ratings are entered by observer. This is likely to be the case, for example, when ratings were taken from forms that individual observers have completed. Ratings might be organized by stimulus, for example, when all observers simultaneously recorded their ratings on keyboards to a central receiving station that stores all responses.

Line 4. Name of data file.—This name may contain up to 8 characters, with an extension of up to 3 characters, following standard DOS for personal computers. A full path may be included, if needed.

Line 5. Input format of data.—A standard FORTRAN format statement, of type integer, is required describing the format of each case of data. A FORTRAN statement allows two ways of skipping over unwanted information or blank spaces in a file: (1) A "T" can be used to move to an indicated column; for example, a "T4" indicates that what follows will begin in column 4. (2) An "X" can be used to skip a given number of columns; for example, a "3X" indicates that the next three columns are to be skipped. Data to be read are indicated with an "I", with the number of columns per rating value listed after the I and the number of values in succession listed before the I; for example, a "5I2" indicates that 5 values will be read in two-column fields. Only the integer (I) format is allowed. Decimal points are not allowed within the columns where data are to be read. Finally, if the data for each case are to be read from more than one line, a

"/" is used to indicate the end of a line. The format statement in appendix B (T22, 13I2) indicates that the 13 two-column ratings of each case (which is a single stimulus, as indicated by line 3 of appendix B) begin in column 22. The first 21 columns of the sample data file, which contain additional information about the stimuli, are ignored.

Line 6. Number of rating values.—Enter the number of possible responses on the rating scale used by the observers. RMRATE requires this to be a number between 5 and 10 (i.e., the largest rating scale permitted is a 10-point scale).

Line 7. Output rating scale.—First, enter the value to be printed in the output to indicate that the stimulus was not rated by an observer (that the rating is missing). Only numerical values, in a field of up to four characters, are permitted. Thus, possibilities for indicating a missing value include a single-digit number (e.g., 0), a negative number (e.g., −9), and a two-digit number (e.g., 99). If this field is left blank, RMRATE will print a "0" to indicate a missing value.

Then enter each value of the rating scale to be used in the output, beginning with "least preferred" (lowest perceived value) and ending with "most preferred" (highest perceived value). This scale would normally be identical to the rating scale used by the observers. Line 7 of appendix B indicates that a 0 is to be used in output to indicate no response, and that a 10-point scale is to be used with a "1" used to indicate "least preferred," etc.

Line 8. Input rating scale.—First, enter the value used in the data to indicate that a stimulus was not rated by an observer (that the rating is missing). Note that RMRATE does not distinguish between zeros and blanks, so that if "0" is one of the rating values, a blank could not be used to indicate a missing rating value. Then enter the values of the rating scale in which the observers' responses are recorded in the data file, again from "least preferred" to "most preferred." Line 8 of appendix B indicates that a "−1" is used in the data file (appendix A) to indicate no response and that the ratings are in terms of a 0–9 scale. A 0–9 scale is sometimes used to compress 10-point scale responses to one column each, but of course this procedure can only be used with RMRATE if there are no blanks since a 0 is synonymous with a blank. Because a "−1" was used to indicate missing data, the data in appendix A could not be compressed to one column per rating value.

Line 9. Number of conditions.—Enter the number of conditions, including the baseline, if any. A "condition" is simply a group of stimuli. For example, if the stimuli are landscape scenes, a condition might be all the scenes from a certain park or forest area. A maximum of 20 conditions can be specified. Line 9 of appendix B indicates that 3 conditions will be used in the example. If all stimuli are of the same condition (or no condition distinctions are desired), enter a "1".

Line 10. Condition definitions.—Enter one line for each condition. Each line gives the condition name and then indicates which stimuli are included in that condition. If there is only one condition (a "1" was entered on line 9), a name must still be entered, and RMRATE considers all stimuli to be the baseline. The baseline is important in several of the scaling methods used by RMRATE (see Brown and Daniel 1990). If there is more than one condition, the baseline condition must be listed first; it would normally be named "baseline," but any name can be used. RMRATE does not allow specification of more than one condition without one of them being the baseline. Thus, one could not specify two conditions and use all stimuli as the baseline.[3]

The stimuli included in a condition are indicated by sequence number (the order in which they occur on the data file). There are three options for indicating stimulus sequence numbers: (1) The list option allows the sequence numbers of the stimuli to be specifically enumerated (not necessarily in sequential order). The BASELINE condition is specified in appendix B using this option, showing that 10 stimuli (the first through the tenth stimulus) are in this condition. (2) The pattern option allows every n^{th} stimulus to be easily assigned to a condition. The MIXPRE condition is specified in appendix B using this option and has 14 stimuli (11, 12, 13, . . .,24). (3) The final option allows all stimuli not yet assigned to a condition to be assigned to the designated condition. The MIXPOST condition is specified in appendix B using this option. If only one condition is listed, it must still be named, and the included stimuli must be designated, which can easily be done using the third option.

Line 11. Stimulus names.—A name may be given to each stimulus for identification in the output. List each name on a separate line. The order must match the order in which the stimulus ratings are listed in the data file. If names are not desired, enter "NO NAMES," and the stimuli will be identified in the output by their input sequence numbers.

Line 12. Removal controls.—Observers or stimuli may be removed from the analysis if they do not meet certain criteria. The following three criteria are available for removing observers: (1) excessive missing ratings, (2) inadequate range of rating values used, and (3) inadequate correlation of an observer's ratings with the mean ratings for the group of all other observers. A stimulus may be removed if an excessive number of observers did not rate the stimulus. If missing ratings remain after the removal specifications have been processed, each missing rating is replaced with the respective observer's mean rating before analysis begins. This replacement occurs even if most of an observer's ratings are missing, as long as the observer meets the other criteria for inclusion.

To avoid biasing the results, the range-of-rating-scale and correlation criteria for removing observers must be used with great caution. The principal reason for the former criterion is to remove observers who showed no discrimination among the stimuli. If an observer used a uniform rating for all stimuli (e.g., assigned all "5"s),

[3]To simulate this, one could duplicate the data set so that the input data file contained two sequential sets of the same data, and then indicate in the control file that the first set was the baseline and that the second set contained the two other conditions.

some of the analyses would be mathematically undefined; thus, the default range is 1. Users have the option, however, to remove observers who showed some, but insufficient, discrimination among the stimuli. The other criterion allows the user to remove observers whose ratings correlate too poorly with the mean ratings of the other observers. This may be used, for example, to remove observers whose correlation with the group of all other observers is strongly negative (e.g., a -0.7), which could indicate that the observer misinterpreted the rating scale, confusing "most preferred" with "least preferred," and vice versa. Again, care should be exercised when using these criteria.

Line 13. Exclusion of observers.—This line allows observers to be unconditionally excluded from the analysis. The input format requires listing ranges of observers to be excluded, indicated by the sequence number of the first and last observer in the range.

Line 14. Exclusion of stimuli.—This line allows stimuli to be unconditionally excluded from the analysis. As in line 13, the input format requires listing ranges of stimuli to be excluded.

Line 15. Principal component analysis controls.—The user has the option of choosing the number of principal components for which component loadings and component scores will be included in output. This can be done by specifying either the number of components to be included or the minimum eigenvalue for a component to be included. If a specific number of components is specified, RMRATE chooses the components to include in order of decreasing eigenvalue. If the user does not specify one of these options, all components with an eigenvalue greater than or equal to 1.0 will be included in the output.

The principal component analysis requires more memory for a given data set than do the other analyses. If all observers cannot be included in this analysis, users have two options for reducing the number of observers. The first option is to let RMRATE randomly select the observers to be included. RMRATE will select the maximum number possible. The random number generator in RMRATE (L'Ecuyer 1988) can take its seed from the date and time on the computer's clock; this is the default option. However, the user can enter seeds (two are required), which allows the user to replicate the selection of observers (demonstrating that the "random number" generator is not truly random, but is the best approximation available). The second option is to specify which observers are to be included in the principal component analysis. This can be done by specifying a pattern (as described for input line 10) or by specifying the sequence number of each observer to be included.

The principal component analysis can be quite time consuming. The time required to perform the analysis increases geometrically as the number of observers increases. On a PC, the time required for large data sets may seem unduly long, and since most of the matrix operations are performed in memory, there is no visible evidence that RMRATE is not hung. Have patience. On a timesharing mainframe, the costs may increase dramatically for large data sets.

Line 16. Output options.—The available output consists of 19 displays. The displays consist of one or more tables or two-dimensional plots. Each of the displays is described in the "Output" section, below. Example displays are presented in appendix C.

In addition to being printed or written to a file, some of the displays can also be written to a file in more machine-readable form for use as input in other programs. This option is available for displays 1, 2, 4, and 9 through 12. Appendix D gives an example of the more machine-readable version of display 4.

The user indicates which displays are desired in the first 19 columns of line 16. A "1" is entered in the column if the user wants the display represented by that column to be included as output, and a "2" is entered in the column if the display is wanted both in the regular output and in more machine-readable form. Column 1 represents display 1, column 2 represents display 2, etc. The user can use the column indicator of an editor program to keep track of the columns.

At the right-hand end of line 16, the absolute value of the correlation coefficient cutoff for printing plots of pairs of scaled values is entered. Scattergrams are generated for those pairs of statistics in display 6 whose correlation coefficient (absolute value) is less than the threshold. See the discussion of display 8 in the "Output" section for more on this option.

Line 17. "Saved output" file name.—This line gives the name of the file to which tables are written in more machine-readable form. All available displays requested with a "2" on line 16 are written to this one file. A file by this name may not already exist on the directory to which the file is directed. This line *must* be included, even if no output is to be saved in more machine-readable form. If no machine-readable tables are wanted, enter "NONE."

INPUT PARAMETERS

Line	Parameters and descriptions	Columns	Example	Comments on example
1	Title. 80 characters or less are entered to identify the data set, the run, or other pertinent information.	1–80	SAMPLE RUNSTREAM	
2	Memory requirements. Enter the number of observers and the number of stimuli.	1–5 6–10	13 35	13 observers, 35 stimuli
3	Input option. Leave blank if input is by observers: an observer's ratings for all stimuli are read in before proceding to another observer. Enter 1 if input is by stimuli: all observers' ratings for a single stimulus are read in before proceding to another stimulus.	5	1	Input by stimuli
4	Ratings (input data) file name.	1–80	SAMPLE.DAT	PC style file name
5	Input format. Standard FORTRAN format statement describing the input ratings on the file named above. Must be INTEGER type, enclosed by parentheses.	1–80	(T22,13I2)	Example 1: Reads 13 values per line in 2-column fields beginning in column 22
		1–80	(10X,15I2/5X,20I2)	Example 2 (not included in appendix B): Reads 15 values on first line in 2-column fields, beginning in column 11, then 20 values on second line, beginning in column 6
6	Number of rating values, not including the value used to indicate missing data (5 ≤ N ≤ 10). This is the number of rating values permitted to an observer.	4–5	10	10 possible values in the rating scale besides blank
7	Rating scale desired in output. Enter the "not rated" (i.e., missing) value.	1–5		A blank = missing; RMRATE will print a 0
	In subsequent 5 column fields, begin with the "least preferred" value and proceed to the "most preferred" value. The number of values should correspond with the information on input line 6.	6–10 11–15 16–20 21–25 26–30 31–35 36–40 41–45 46–50 51–55	1 2 3 4 5 6 7 8 9 10	RMRATE will print results in terms of a 10-point scale
8	Rating scale used for input. Enter the "not rated" (i.e., missing) value. In subsequent 5 column fields, beginning with the "least preferred" value, enter the scale found in the data file named on input line 4. This scale may be identical to that on line 7, but it must still be repeated here.	1–5	–1	A –1 indicates a missing value
		6–10 11–15 16–20 21–25 26–30 31–35 36–40 41–45 46–50 51–55	0 1 2 3 4 5 6 7 8 9	The data file lists ratings on a 0–9 scale
9	Number of conditions, including the baseline (1 ≤ N ≤ 20).	4–5	3	Baseline and 2 conditions

Line	Parameters and descriptions	Columns	Example	Comments on example
10	Condition definitions. There must be one line for each condition specified on line 9. The baseline condition must be first.			
	Condition name.	1–10	BASELINE	The name of the first condition
	Stimuli belonging to this condition			
	To specifically enumerate the stimuli belonging to a condition, enter the number of stimuli belonging to the condition;	11–15	10	
	enter in subsequent 5-column fields the sequence number of each stimulus belonging to this condition. Continue on subsequent lines, if necessary. Stimuli need not be listed in numerical order.	16–20	1	Stimuli 1–10 belong to this condition
		21–25	2	
		26–30	3	
		31–35	4	
		36–40	5	
		41–45	6	
		46–50	7	
		51–55	8	
		56–60	9	
		61–65	10	
	Condition name.	1–10	MIXPRE	The name of the second condition
	Stimuli belonging to this condition.			
	To specify a pattern for stimuli belonging to this condition, enter a 0;	11–15	0	
	enter the sequence number of the 1st stimulus in the pattern;	16–20	11	Stimuli 11, 12, . . ., 24 are all assigned to this condition
	enter the increment in the pattern;	21–25	1	
	enter the sequence number of the last stimulus in the pattern.	26–30	24	
	Condition name.	1–10	MIXPOST	The name of the third condition
	Stimuli belonging to this condition.			
	Enter –1 to cause all stimuli not yet assigned to another condition to this condition. This specification can only be used with the last (or only) condition.	11–15	–1	All stimuli not yet assigned to an earlier condition
11	Stimuli names. If no names are assigned to the stimuli, enter NO NAMES. If each stimulus has a name or identifier, use one line for each stimulus (one name per line), with the name in columns 1–10.	1–10	NO NAMES	RMRATE will assign each stimulus' input order no. as its "name"
12	Removal controls.			
	Excessive missing ratings by an observer. Enter the number of missing responses which would be unacceptable and cause the observer to be removed from the analyses ($1 \leq N \leq$ number of stimuli + 1). If none are to be removed regardless of the number of missing ratings, enter number of stimuli + 1.	1–5	1	Any observer leaving 1 or more ratings blank will be removed
	Excessive missing ratings among all observers for a single stimulus ($1 \leq N \leq$ number of observers + 1). If none are to be removed regardless of the number of missing ratings, enter number of observers + 1.	6–10	1	Any stimulus which was not rated by 1 or more observers will be removed
	Poor correlation of an observer's ratings with rest of the group's ratings. Enter threshold r coefficient, below which an observer will be removed. If none are to be removed regardless of correlation with the group, enter –2.0.	11–15	–.7	Any observer with $r < -.7$ will be removed
	Poor range of ratings. If an observer used a uniform rating value for all stimuli, some of the analyses would break down mathematically. Thus, the default minimum range for inclusion is a 1, but the user may require a greater range if desired. If left blank, the default is used.	16–20		Blank = default (range of 1)

Line	Parameters and descriptions	Columns	Example	Comments on example
13	Exclusion of observers. Leave line blank if no observers are to be unconditionally excluded. Enter pairs of numbers in 5-column fields as shown to the right to identify ranges of observers to be unconditionally excluded. The numbers correspond to input order; i.e., entering a 10 would cause the tenth observer to be excluded. Each pair represents a series (a range) of observers to be excluded: the first number represents the first observer in a series and the second represents the last observer of the series. If a series consists of only one observer, enter that number in the first position AND in the second position, or the second position may be left blank. Continue entering pairs as required, and continue on subsequent lines if necessary. Terminate the list with at least one pair of blank columns, even if another line is required.	1–5 6–10	3	Exclude the third observer
		11–15 16–20		Blank pair to end list of exclusions
14	Exclusion of stimuli. Same instructions as for exclusion of observers in line 13 above, except the numbers represent the input order of the stimuli. Again, a blank line means the user is not unconditionally excluding any stimulus.	1–5 6–10	13	Exclude thirteenth observer
		11–15 16–20	17	Exclude seventeenth observer
		21–25 26–30	32 33	Excluded observers 32 to 33
		31–35 36–40		Blank pair to end list of exclusions
15	Principal component analysis controls. If column 13 of input line 16 does not indicate that the principal component analysis is to be done, leave this line blank. If the principal component analysis is to be done, but the defaults are acceptable, it may also be left blank.			
	Number of components to be printed.	1–5		Blank = default (to be determined on basis of eigenvalues)
	Minimum eigenvalue for a component to be printed. Default = 1.0. Note that if both the number of components to be printed and the minimum eigenvalue are specified, the one which will print the fewest components determines the number to be displayed.	6–10		Blank = default (print all components whose eigenvalues are $\geq$ 1.0)
	Identifying observers to be included in the principal component analysis.			
	Automatic identification.			Example 1:
	Enter a 0 or blank. RMRATE will include all observers, if possible.	11–15		Blank = 0
	Enter a numerical seed of 1 to 5 digits for the random number generator (or leave blank and RMRATE will pick a seed) which will randomly select observers to include when it is not possible to use all of them.	16–20		Blank = RMRATE picks seed
	Enter a second seed for the random number generator (or leave blank—if a seed was entered in the previous field, one must also be entered here).	21–25		Blank = RMRATE picks seed
	To specify a pattern,			
	enter –1;	11–15	–1	Example 2 (not in appendix B):
	enter the sequence number (input order) of the 1st observer in the pattern;	16–20	3	
	enter the increment in the pattern;	21–25	4	
	enter the sequence number of the last observer in the pattern.	26–30	247	Observers 3, 7, 11, . . ., 247 are all to be included in the factor analysis
	To specifically enumerate the observers to be included, enter in 5-column fields the sequence number of each observer to be included. Continue on additional lines, if necessary.	11–15 16–20 21–25 26–30 31–35 36–40 41–45 46–50 51–55	17 33 65 83 90 91 92 105 107	Example 3 (not in Appendix B): Include 9 obs.: 17, 33, 65, 83, 90, 91, 92, 105, 107

Line	Parameters and descriptions	Columns	Example	Comments on example
16	Output options.			
	Output display selection. Each column represents the display by the same number. If the display is to be omitted, leave the column blank.			
	If the display is to be generated, enter a 1. If the display can be written to the "saved output" file (see line 17 below) in more machine-readable form, and if this additional output is desired, enter 2 for the display to be both generated and saved.			
	Display 1. Raw ratings and associated statistics. (May be saved.)	1	1	Displayed
	Display 2. Ratings and associated statistics. (When this display requested, it will be generated only if observers and/or stimuli are removed or if display 1 was not requested. May be saved.)	2	1	Displayed
	Display 3. Correspondence among observers.	3	1	Displayed
	Display 4. Analysis by stimuli. (May be saved.)	4	2	Displayed and saved on file
	Display 5. Distribution of ratings.	5	1	Displayed
	Display 6. Stimulus-level correlation table.	6	1	Displayed
	Display 7. Condition-level correlation table.	7	1	Displayed
	Display 8. Scattergram of two output measures. (See columns 21–25 if this display is to be generated)	8	1	Displayed
	Display 9. Z-scores and associated statistics. (May be saved.)	9	1	Displayed
	Display 10. Least squares ratings and associated statistics. (May be saved.)	10	1	Displayed
	Display 11. Baseline-adjusted Z-scores and associated statistics. (May be saved.)	11	1	Displayed
	Display 12. Baseline-adjusted least squares ratings and associated statistics. (May be saved.)	12	1	Displayed
	Displays 13 – 18. Principal component analysis. (See input line 15 for further requirements on this and other principal component analysis displays. Note that because of the matrix manipulations, the elapsed time to perform the principal component analysis increases geometrically as the number of observers increases; i.e., on a mainframe, beware of high costs with large data sets; on a PC, be patient!)			
	13. Eigenvalues.	13	1	Displayed
	14. Component loadings.	14	1	Displayed
	15. Component scores.	15	1	Displayed
	16. Scattergrams of component loadings for component 1 vs. loadings of other selected components.	16	1	Displayed
	17. Scattergrams of component scores for component 1 vs. scores of other selected components.	17	1	Displayed
	18. Correlations of components with other measures.	18	1	Displayed
	Display 19. Analysis by observers.	19	1	Displayed
	Threshold correlation coefficient for display 8. Required only if column 8 is not blank. The threshold must be greater than or equal to 0 and less than or equal to 1. A 0 would mean no plots would be generated; 1 would mean all plots would be generated.	21–25	.987	Plots statistics with $-.987 < r < .987$ in display 6
17	"Saved output" file name. May NOT be the same as the file name on line 4. If no such capturing is wanted, enter NONE in columns 1–4.	1–80	SAMPLE.SAV	PC style file name

Output

RMRATE output is described in this section. The output consists of a listing of the input parameters, plus 19 "displays." The displays consist of one or more tables or figures. Examples of an input parameter listing and associated displays are shown in appendix C, and an example of a more machine-readable version of display 4 is shown in appendix D. Examples mentioned in this section refer to the appendix C and D displays.

Display 1. Raw ratings and associated statistics.—This table presents three kinds of information: raw ratings, statistics for each observer and each stimulus, and marks indicating which stimuli and observers are to be removed.

The raw ratings are listed for all observers and stimuli that were included in the input data file. The ratings are listed using the rating scale entered in line 7 of the input controls, which may not be the same as the scale in which the ratings are recorded on the data file. The observers and stimuli are listed in the order in which they were read in. The observers are indicated by the sequence number of the order in which they were read in. The stimuli are indicated by sequence number unless they were given names in line 11 of the input, in which case the names are shown. In addition, the stimulus conditions are listed.

Statistics are provided for each observer and stimulus. For each observer, the following statistics are computed across all stimuli: (1) mean rating, (2) median rating, (3) standard deviation of the ratings, (4) range of the rating scale used by the observer, (5) skewness of the observer's ratings, (6) Pearson correlation coefficient of the observer's ratings with the mean ratings of all other observers, and (7) significance of that correlation. For each stimulus, the following statistics are computed across all observers: (1) mean rating, (2) median rating, (3) standard deviation of ratings, and (4) range of the ratings assigned to that stimulus by all observers.

Marks are used to indicate which observers and stimuli are to be removed from the analyses to follow, and why they are to be removed. In display 1 (appendix C), these marks are found next to observers 3, 9, 11, and 13 and next to stimuli 5, 13, 17, 32, and 33. There are four possible reasons for removal of observers or stimuli: (1) they were excluded a priori by the user (observer 3, stimuli 13, 17, 32, and 33), (2) there were excessive blank responses (observer 13, stimulus 5), (3) an observer's ratings did not correlate well with the mean ratings of all other observers (observer 9), and (4) an observer used an inadequate range of the rating scale (observer 11). For computational reasons, an observer will be removed by default if the range is zero, indicating that he/she assigned all stimuli the same rating.

Display 2. Ratings and associated statistics.—This table is identical to the table of display 1 except that it does not include the observers or stimuli that were removed. Display 2 thus displays only those observers and stimuli that will be included in the analyses to follow. Display 2 cannot be generated if no observers or stimuli were removed and display 1 was already generated in the same run. Notice in display 2 that the observers and stimuli retain their original (display 1) sequence numbers. Also note, by comparing displays 1 and 2, that removal of observers and stimuli affects the statistics for the remaining stimuli and observers.

Display 3. Correspondence among observers.—This display is a set of four different kinds of tables. First, the numbers of observers and stimuli that were removed are listed according to the reason for removal, and the remaining totals are given. Second, the minimum, maximum, and mean of the Pearson correlation coefficients of each observer's ratings with the mean ratings across all other observers are listed, first across all observers and then across all included observers. Comparison of these two sets of coefficients indicates the effect of the removals on relative correspondence among observers. Third, a standard two-way analysis of variance table (stimuli-by-observers) is presented of the ratings of the included observers. This table facilitates tests of two hypotheses: that the observers did not differ in their ratings, and that the ratings of the stimuli do not differ.

Results of the analysis of variance are used to produce the fourth table, which gives observer-to-observer and group-to-group reliability statistics for the ratings. The observer-to-observer reliability statistic gives the expected correlation between any two observers drawn from the observer population at issue. The group-to-group reliability statistic indicates the expected correlation between group mean ratings for two groups of observers of the same size as the one at issue.

The analysis of variance and reliability tables are then repeated for Z-scores of the ratings.

Display 4. Analysis by stimuli.—This table is perhaps the focal point of RMRATE output. It presents the results of 10 different scalings of the ratings, plus 5 statistics. These results are presented for each stimulus, each condition, all stimuli together, and all nonbaseline stimuli together. The individual stimulus results are presented in groups by condition. The 15 scale values and statistics, listed in the order they appear in display 4, are:

1. Mean rating
2. Median rating
3. Standard deviation of ratings
4. Mean origin-adjusted rating (OAR)
5. Mean Z-score based on ratings of all stimuli
6. Mean least squares rating (LSR) based on ratings of all stimuli
7. Mean OAR based on ratings of baseline stimuli
8. Mean Z-score based on ratings of baseline stimuli
9. Mean LSR based on ratings of baseline stimuli
10. By-stimulus SBE
11. Standardized by-stimulus SBE (SBE*)
12. Skewness of ratings
13. Skewness of Z-scores based on ratings of all stimuli
14. Kurtosis of ratings
15. Modified Anderson-Darling statistic.

The 10 scaling procedures are described briefly here, and in detail by Brown and Daniel (1990). The median rating is the midpoint rating in the set of ordered ratings. The mean rating is the arithmetic mean, rounded to two

digits. An OAR is an original rating minus the respective observer's mean rating. A Z-score, or standardized rating, is an original rating minus the observer's mean rating, this difference divided by the standard deviation of the observer's ratings. An LSR is based on the linear fit of an observer's ratings with the mean ratings assigned by the entire group of observers. Two sets of OARs, Z-scores, and LSRs are provided. In the first set, the adjustments are based on ratings of all stimuli (e.g., an OAR is an original rating minus the observer's mean rating across *all* stimuli). In the second set, the adjustments are based on ratings of the baseline stimuli only (e.g., a baseline-adjusted OAR is an original rating minus the observer's mean rating across the *baseline* stimuli). The by-stimulus SBE is the Scenic Beauty Estimate introduced by Daniel and Boster (1976) as the "by-slide" SBE. Finally, the SBE* is a fully standarized by-stimulus SBE, where ratings of the baseline stimuli are used not only to determine the origin of the SBE scale (as with the original SBE), but also the scale's interval size.

The summary values, those for each condition, all stimuli, and all nonbaseline stimuli, are computed by averaging the individual stimulus values across the relevant stimuli. For example, the all-stimuli SBE (-8.25, display 4) is the mean of the 30 individual stimulus SBEs, and the all-stimuli standard deviation of ratings (1.94, display 4) is the mean of the 30 individual stimulus standard deviations.

Display 5. Distribution of ratings.—This display contains two tables. The first table lists the proportion of included observers using each possible range of the rating scale. For example, the ".444" in the first line of display 5 indicates that 44% of the observers recorded ratings that ranged 8 rating values from the lowest to highest rating, such as from "1" to "9", or "2" to "10". This gives one indication of the degree to which observers discriminated among the stimuli. The second table gives the proportion of the ratings in each rating category for each stimulus and each condition. For example, the ".012" in the upper left portion of the table indicates that 1.2% of the respondents rated the average baseline stimulus a "1". Similarly, 22% of the respondents rated stimulus number 4 a "2". These proportions indicate the agreement among observers about specific stimuli, as well as the distribution of ratings about the mean rating.

Display 6. Stimulus-level correlation table. This table lists Pearson correlation coefficients of the scale values of the stimuli for pairs of the scaling methods listed in display 4. For example, the correlation of mean ratings with mean Z-scores across the 30 included stimuli was 0.988 (display 6), indicating that mean Z-scores are nearly a precise linear transformation of mean ratings. All of the correlation coefficients in display 6 are above 0.985. Other data might produce lower correlation coefficients. Note that correlations with SBE*s are not listed because they are identical to those for SBEs.

Display 7. Condition-level correlation table.—This table lists correlation coefficients, similar to display 6, but here conditions rather than stimuli are the cases of analysis. If only one condition was specified by the user (input lines 9 and 10), this table cannot be generated. If two conditions were specified, the table can be generated, but it is meaningless; with few conditions, the correlation coefficients must be quite high to be significant.

Display 8. Scattergram of two output measures.—This display is a set of two-dimensional plots of scale values, one for each pair of measures for which the absolute value of the correlation coefficient in display 6 is less than the threshold specified at the end of input line 16. Normally, it is not necessary to plot very high correlations, as values above about 0.9 are only achieved when there is little or no "scatter" around a linear relationship. For the test data set, however, a threshold level of 0.987 was specified, so that two plots (those comparing SBE with baseline-adjusted Z-scores and least squares ratings) would be printed for illustration purposes.

Display 9. Z-scores and associated statistics.—This table lists the Z-scores for each observer-by-stimulus combination, plus some statistics about the observers and stimuli. The table is identical to display 2, except that it presents Z-scores rather than ratings. **Displays 10 through 12** are identical in form to display 9, but present least squares ratings, baseline-adjusted Z-scores, and baseline-adjusted least squares ratings, respectively. Each of these four displays is perhaps most useful in machine-readable form, for use as input to other programs. That option is requested on input lines 16 and 17.

Display 13. Eigenvalues.—This table lists all eigenvalues of the principal component analysis of the ratings and the percent of variance accounted for by each component. The percent of variance is the eigenvalue divided by the number of observers. The number of eigenvalues is equal to the number of included observers, in this case 9. If the data set is large, the number of observers included in the principal component analysis may need to be less than the number included in the other analyses of the run. If the number of observers must be reduced for the principal component analysis, and the user did not select the observers to be included on input control line 15, the maximum possible number of observers is randomly selected by RMRATE.

No reduction in number of observers was necessary for the test data set. The eigenvalues for the test data set vary from 3.634 to 0.2926 (display 13). The first principal component accounts for 40% of the variance in the ratings of the 9 included observers. The second and third components account for an additional 14% and 12%, respectively, suggesting that there may be some consistent variations in preference among subsets of the observers.

Display 14. Principal Component loadings.—This table lists the component loadings of the selected components for each included observer. Unless the desired components were specified by the user on input control line 15, RMRATE prints loadings for all components with an eigenvalue of 1.0 or more. This default was chosen for the test data set (notice the blank line 15 of the input controls, appendix B), resulting in the listing of loadings for three principal components (display 14).

These loadings suggest that several observers have perceptions that diverge somewhat from the aggregate or consensus preference. Specifically, observers 7 and 8 have their strongest loading on component 2 rather than component 1, and observer 5's strongest loading is on component 3. Observers 2 and 10 also have moderately strong loadings on components 2 and 3, respectively. This suggests that components 2 and 3 may reflect perceptual dimensions of the stimuli to which these observers have divergent responses.

Display 15. Principal Component scores.—This table lists component scores of the selected components for each stimulus. The scores for the three components selected for the test data set are shown in display 15. The scores of stimuli on the first principal component represent the majority or aggregate consensus of the observers. They will almost always correlate very closely with the scale values obtained from the other analyses in RMRATE. In fact, the scores for the first principal component may be viewed as an additional option for scaling the stimuli. Note, however, that the direction of the scale for the component scores may occasionally be opposite to that of the other scales. That is, high component scores may correspond to low ratings and low component scores may correspond to high ratings. When this occurs, the majority of observers will have negative loadings on component 1 in display 14.

The scores on the other components may be helpful for interpreting variations in perceptions within the group. This is done by examining the stimuli that have the highest and lowest scores on each component. For example, on component 2 the highest scores are for stimuli 4 and 11. Observers with strong positive loadings on component 2 (i.e., observers 2 and 8) gave higher than average ratings to these stimuli, and lower than average ratings to stimuli with low scores on component 2 (e.g., stimuli 16 and 20). On the other hand, observer 7's strong negative loading on component 2 means that he or she gave higher than average ratings to stimuli 16 and 20, and lower than average ratings to stimuli 4 and 11.

To interpret variations in preference, the investigator must be able to discern features that differentiate stimuli with high loadings on a component from stimuli with low loadings on the same component. Frequently this can be done with an "eyeball" examination of the stimuli. If measures of physical features of the stimuli are available, these can be correlated with or regressed on the component scores to obtain a more rigorous interpretation of each component. Schroeder (1987) provides a detailed example of this procedure.

Display 16. Scattergram of component loadings.—This display consists of a set of two-dimensional plots, each showing the loadings of component 1 plotted against the loadings of one of the other selected components. For the test data set, where three components were selected, this resulted in two plots. The plots of component loadings are provided as an aid to identifying observers that have high and low loadings on each principal component, and for obtaining an overall visual display of how observers are distributed over the dimensions of the principal component solution.

Each observer is indicated on the plots by a letter. RMRATE assigns letters sequentially to observers, in the order in which observers were entered in the data file. First, the set of upper-case letters is used, followed by the set of lower-case letters. If additional symbols are needed, the program repeats this procedure. If more than one observer is plotted in the same cell, each is assigned the same letter. Each plot is preceded by a list of the plotted observers and their respective symbols and loadings for the two plotted components.

Display 17. Scattergram of component scores.—This display consists of a set of two-dimensional plots, each showing the scores of component 1 plotted against those of one of the other selected components. Again, for the test data set, this resulted in the printing of 2 plots. The plots of component scores are provided as an aid to identifying stimuli that have high and low scores on each component, and for obtaining an overall visual display of how stimuli are distributed over the dimensions of the principal component solution.

As with the plots of component loadings, the component score plots indicate the stimuli by upper- and lower-case letters. Each plot is preceded by a list of the stimuli and their respective symbols and scores for the plotted components.

Display 18. Correlation of component scores with other measures of interest.—This table gives Pearson correlation coefficients of the scores for the selected components with the scale values for the scaling methods included in display 4. For example, the correlation coefficient of the scores for component 1 with the mean ratings for the stimuli is 0.981 (display 18). The correlation coefficients in display 18 indicate that, as noted above, the scores on component 1 correspond closely to the other aggregate scale values calculated by RMRATE. The remaining components have negligible correlations with the other scale values. This is to be expected, since these components are constrained to be statistically independent of component 1.

Display 19. Analysis by observers.—This table presents by-observer SBEs, plus mean and median ratings and additional statistics, for each individual observer. This is done for all stimuli, all nonbaseline stimuli, and for each condition. Each observer's value represents his or her responses to the stimuli in the respective set of stimuli. For example, observer 1's mean rating across all stimuli was 7.30, and that observer's mean rating across the baseline stimuli was 7.11 (display 19). Similarly, the standard deviations of observer 1's ratings of all stimuli and the baseline stimuli were 0.88 and 0.93, respectively (display 19). Note that in display 19 the values for all stimuli, all nonbaseline stimuli, and the conditions (MIXPRE and MIXPOST) are the averages of the individual observer values. Thus, the all-stimuli standard deviation (1.74) is the mean of the 9 observers' standard deviations.

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APPENDIX A

SAMPLE DATA FILE: SAMPLE.DAT

```
                 1  4  4.1  6  6  4  5  3  4  2  5  7  6  3  5  5  3
                 2  4  4.3  6  3  7  5  4  3  1  3  2  5  4  5  0  2
                 3  4  3.2  5  3  1  2  2  3  2  2  4  7  2  5  3  4
                 4  4  4.1  6  6  2  4  2  4  1  1  7  5  4  5  2  4
                 5  4  4.8  6  2  3  4  2  7  1  5  6  5  4  5  6 -1
                 6  4  4.4  6  6  5  4  3  5  2  2  6  7  2  5  3  4
                 7  4  4.0  6  2  1  5  3  4  2  3  3  7  2  5  4  3
                 8  4  5.4  7  8  4  6  3  8  1  7  5  5  4  5  6  5
                 9  4  3.1  5  3  4  4  2  4  1  4  5  8  1  5  2  2
                10  4  7.2  8  7  8  8  5  7  8  8  9  3  6  5  8  4
79  511  5   1   2  4   3   5  4  3  3  2  5  0  2  8  5  4  5  1  6
79  511  5   1   4  4   3   5  3  4  5  4  4  0  3  1  7  2  5  1  4
79  511  5   4   2  4   5   6  7  7  7  4  8  6  7  8  4  5  5  2  6
79  511  5   4   4  4   3   6  3  4  4  3  5  2  4  4  7  2  5  1  3
79  511  5   5   2  4   4   6  2  5  6  4  6  1  6  7  5  4  5  0  4
79  511  5   5   4  4   4   7  3  6  7  4  6  5  6  1  4  5  5  1  5
79  511  5   6   2  4   4   5  1  6  5  5  5  0  4  8  5  4  5  1  5
79  511  5   6   4  4   3   7  3  7  4  3  4  3  5  2  6  3  5  2  5
79  511  5   9   2  4   3   6  3  2  3  2  5  1  7  0  8  1  5  3  1
79  511  5   9   4  4   3   6  2  4  3  6  4  2  6  1  7  2  5  2  3
79  511  5  10   2  4   3   6  0  5  4  3  4  0  7  2  7  2  5  3  3
79  511  5  10   4  4   3   7  1  4  4  3  4  1  3  3  7  2  5  4  4
79  539  1   2   2  4   4   8  5  3  7  3  5  3  4  8  8  1  5  2  5
79  539  1   2   4  4   6   7  8  6  8  7  5  4  7  7  4  5  5  7  5
80  511  5   1   2  4   3   6  5  3  3  5  5  3  0  6  7  2  5  1  5
80  511  5   1   4  4   4   6  3  6  7  4  3  2  3  2  6  3  5  6  3
80  511  5   4   2  4   3   6  4  3  6  4  6  1  0  0  5  4  5  2  3
80  511  5   4   4  4   4   7  4  4  6  4  5  2  7  7  7  2  5  4  4
80  511  5   5   2  4   3   7  4  6  4  6  3  1  0  6  6  3  5  2  4
80  511  5   5   4  4   4   5  5  5  6  4  4  2  6  5  5  4  5  3  4
80  511  5   6   2  4   3   6  4  7  5  4  3  1  0  6  5  4  5  5  4
80  511  5   6   4  4   3   7  4  7  3  3  2  1  3  1  6  3  5  3  2
80  511  5   9   2  4   3   7  5  3  5  1  3  1  6  1  8  1  5  3  1
80  511  5   9   4  4   4   7  3  7  3  3  3  2  3  7  6  3  5  5  3
80  511  5  10   2  4   3   8  5  3  3  3  4  2  3  1  8  1  5  4  2
```

APPENDIX B

SAMPLE INPUT PARAMETERS: SAMPLE.RUN

```
SAMPLE RUNSTREAM
      13       35
       1
SAMPLE.DAT
(T22, 13I2)
      10
              1    2    3    4    5    6    7    8    9   10
      -1      0    1    2    3    4    5    6    7    8    9
       3
BASELINE          10    1    2    3    4    5    6    7    8    9   10
MIXPRE             0   11    1   24
MIXPOST           -1
NO NAMES
       1      1   -.7
       3
      13          17        32   33
1112111111111111111       .987
SAMPLE.SAV
```

APPENDIX C

SAMPLE OUTPUT (SAMPLE.OUT)

RMRATE 06-07-90 13:49:47

RMRATE is described in GTR RM-195, "Analysis of Ratings: A Guide to RMRATE," by Thomas C. Brown, Terry C. Daniel, Herbert W. Schroeder and Glen E. Brink. More detail on the scaling procedures and statistics of RMRATE is found in Research Paper RM-293, "Analysis of Ratings: Concepts and Methods," by Brown and Daniel. Both reports are available from Rocky Mountain Forest and Range Experiment Station Publications, 240 W. Prospect St., Fort Collins, CO 80526.

This version of RMRATE requires 560K available bytes of RAM (memory), plus a math coprocessor.

```
NUMBER OF OBSERVERS:  13, NUMBER OF STIMULI:  35
  (RESULTING MEMORY ENVIRONMENT: MAXOBS =   14, MAXFAC =   14)

INPUT IS BY STIMULUS

RATINGS WILL BE READ FROM SAMPLE.DAT

INPUT FORMAT: (T22, 1312)

NUMBER OF RATING VALUES IN THE RATING SCALE:  10

RATING VALUES (NOT RATED, LEAST PREFERRED, . . . , MOST PREFERRED):   0   1   2   3   4   5   6   7   8   9  10
  CORRESPONDING INPUT VALUES                                         -1   0   1   2   3   4   5   6   7   8   9

NUMBER OF CONDITIONS (INCLUDING BASELINE):  3

CONDITION  0:  BASELINE    1   2   3   4   5   6   7   8   9  10

CONDITION  1:  MIXPRE     11  12  13  14  15  16  17  18  19  20  21  22  23  24

CONDITION  2:  MIXPOST    (ALL OTHER STIMULI)

STIMULI NAMES:  NO NAMES

NUMBER OF BLANKS TO CAUSE REMOVAL OF AN OBSERVER:  1

NUMBER OF BLANKS TO CAUSE REMOVAL OF A STIMULUS:  1

CORRELATION COEFFICIENT CUTOFF FOR REMOVAL OF AN OBSERVER:  -.700

MINIMUM RANGE IN RATINGS FOR INCLUSION OF AN OBSERVER:  1

EXCLUDED OBSERVERS:
     3 -        3

EXCLUDED STIMULI:
    13 -       13
    17 -       17
    32 -       33

PRINCIPAL COMPONENT ANALYSIS:  NO SPECIFIED NUMBER OF COMPONENTS TO PRINT

PRINCIPAL COMPONENT ANALYSIS:  DEFAULT MINIMUM EIGENVALUE FOR PRINTING OF COMPONENTS (1.0)

PRINCIPAL COMPONENT ANALYSIS:  ALL OBSERVERS WILL BE INCLUDED

OUTPUT DISPLAYS:  1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
        OPTIONS:  1   1   1   2   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1

PLOT OUTPUT MEASURES WITH CORR. LESS THAN  .987

REQUESTED OUTPUT WILL BE SAVED ON SAMPLE.SAV
```

DISPLAY 1. RAW RATINGS AND ASSOCIATED STATISTICS

STIMULUS	CONDITION	MEAN	MED.	STD. DEV.	RANGE	OBSERVERS: 1	2	3	4	5	6	7	8	9	10	11	12	13
								!						&		*		#
MEAN						7.29	4.91	5.54	5.80	4.51	2.91	5.06	5.46	6.97	3.97	6.00	4.06	4.68
MEDIAN						7.00	5.00	5.00	6.00	4.00	3.00	5.00	6.00	7.00	4.00	6.00	4.00	5.00
STANDARD DEVIATION						.86	1.93	1.85	1.57	1.29	1.69	2.34	2.78	1.50	1.34	.00	1.98	1.27
RANGE						3.0	8.0	7.0	6.0	6.0	8.0	8.0	9.0	7.0	5.0	.0	8.0	5.0
SKEWNESS						.253	.332	-.012	.366	.606	1.773	-.174	-.135	-.859	.193	.000	.603	-.515
CORRELATION W/ GROUP						.377	.501	.395	.650	.380	.660	.305	.390	-.738	.522	.000	.376	.402
SIGNIFICANCE OF R						.013	.001	.009	.000	.012	.000	.038	.010	.000	.001	.000	.013	.009
1	BASELINE	5.62	6.0	1.50	5.0	7	7	5	6	4	3	6	8	7	4	6	6	4
2	BASELINE	4.62	5.0	2.02	7.0	7	4	8	6	5	2	4	3	6	5	6	1	3
3	BASELINE	4.23	4.0	1.69	6.0	6	4	2	3	3	3	3	5	8	3	6	4	5
4	BASELINE	4.77	5.0	2.01	6.0	7	7	3	5	3	2	2	8	6	5	6	3	5
5	# BASELINE	5.08	6.0	1.73	5.0	7	3	4	5	3	2	6	7	6	5	6	7	0
6	BASELINE	5.23	5.0	1.74	5.0	7	7	6	5	4	3	3	7	8	3	6	4	5
7	BASELINE	4.54	4.0	1.76	6.0	7	3	2	6	4	3	4	4	8	3	6	5	4
8	BASELINE	6.08	6.0	1.85	7.0	8	9	5	7	4	2	8	6	6	5	6	7	6
9	BASELINE	4.54	5.0	1.98	7.0	6	4	5	5	3	2	5	6	9	2	6	3	3
10	BASELINE	7.54	9.0	2.26	8.0	9	8	9	9	6	9	9	10	2	7	6	9	5
11	MIXPRE	4.69	5.0	2.18	8.0	6	5	4	4	3	1	3	9	6	5	6	2	7
12	MIXPRE	4.38	5.0	1.98	7.0	6	4	5	6	5	1	4	2	8	3	6	2	5
13	! MIXPRE	6.69	7.0	1.65	6.0	7	8	8	8	5	7	8	9	5	6	6	3	7
14	MIXPRE	4.69	5.0	1.65	6.0	7	4	5	5	4	3	5	5	8	3	6	2	4
15	MIXPRE	5.23	6.0	2.09	7.0	7	3	6	7	5	2	7	8	6	5	6	1	5
16	MIXPRE	5.54	6.0	1.94	6.0	8	4	7	8	5	6	7	2	5	6	6	2	6
17	! MIXPRE	5.15	6.0	2.23	8.0	6	2	7	6	6	1	5	9	6	5	6	2	6
18	MIXPRE	5.23	5.0	1.74	5.0	8	4	8	5	4	4	6	3	7	4	6	3	6
19	MIXPRE	4.23	4.0	2.52	8.0	7	4	3	4	3	2	8	1	9	2	6	4	2
20	MIXPRE	4.77	4.0	2.01	6.0	7	3	5	4	7	3	7	2	8	3	6	3	4
21	MIXPRE	4.62	4.0	2.33	7.0	7	1	6	5	4	1	8	3	8	3	6	4	4
22	MIXPRE	4.69	5.0	1.89	6.0	8	2	5	5	4	2	4	4	8	3	6	5	5
23	MIXPRE	5.77	6.0	2.39	7.0	9	6	4	8	4	4	5	9	9	2	6	3	6
24	MIXPRE	7.15	8.0	1.41	4.0	8	9	7	9	8	5	8	8	5	6	6	8	6
25	MIXPOST	4.92	6.0	2.10	7.0	7	6	4	4	6	4	1	7	8	3	6	2	6
26	MIXPOST	5.31	5.0	1.75	5.0	7	4	7	8	5	3	4	3	7	4	6	7	4
27	MIXPOST	4.31	5.0	2.06	6.0	7	5	4	7	5	2	1	1	6	5	6	3	4
28	MIXPOST	5.85	5.0	1.82	5.0	8	5	5	7	5	3	8	8	8	3	6	5	5
29	MIXPOST	5.15	5.0	2.15	7.0	8	5	7	5	7	2	1	7	7	4	6	3	5
30	MIXPOST	5.54	6.0	1.13	4.0	6	6	6	7	5	3	7	6	6	5	6	4	5
31	MIXPOST	5.31	6.0	1.93	7.0	7	5	8	6	5	2	1	7	6	5	6	6	5
32	! MIXPOST	4.69	4.0	2.02	6.0	8	5	8	4	4	2	4	2	7	4	6	4	3
33	! MIXPOST	4.62	4.0	2.53	7.0	8	6	4	6	2	2	7	2	9	2	6	4	2
34	MIXPOST	5.38	4.0	1.85	5.0	8	4	8	4	4	3	4	8	7	4	6	6	4
35	MIXPOST	4.69	4.0	2.29	7.0	9	6	4	4	4	3	4	2	9	2	6	5	3

! = EXCLUDED BY USER

& = REMOVED BECAUSE OF POOR CORRELATION WITH GROUP

= REMOVED BECAUSE OF EXCESSIVE BLANK RATINGS

* = REMOVED BECAUSE OF POOR RANGE OF RATINGS

DISPLAY 2. RATINGS AND ASSOCIATED STATISTICS

STIMULUS	CONDITION	MEAN	MED.	STD. DEV.	RANGE	OBSERVERS: 1	2	4	5	6	7	8	10	12
MEAN						7.30	4.93	5.80	4.60	2.93	4.90	5.40	3.90	4.07
MEDIAN						7.00	4.50	5.50	4.00	3.00	4.50	6.00	4.00	4.00
STANDARD DEVIATION						.88	1.89	1.61	1.25	1.60	2.43	2.70	1.32	2.03
RANGE						3.0	8.0	6.0	5.0	8.0	8.0	9.0	5.0	8.0
SKEWNESS						.303	.387	.363	.859	1.925	-.069	-.128	.350	.579
CORRELATION W/ GROUP						.479	.573	.641	.361	.647	.299	.348	.518	.544
SIGNIFICANCE OF R						.004	.000	.000	.025	.000	.054	.030	.002	.001
1	BASELINE	5.67	6.0	1.66	5.0	7	7	6	4	3	6	8	4	6
2	BASELINE	4.11	4.0	1.90	6.0	7	4	6	5	2	4	3	5	1
3	BASELINE	3.78	3.0	1.09	3.0	6	4	3	3	3	3	5	3	4
4	BASELINE	4.67	5.0	2.29	6.0	7	7	5	3	2	2	8	5	3
6	BASELINE	4.78	4.0	1.79	4.0	7	7	5	4	3	3	7	3	4
7	BASELINE	4.33	4.0	1.41	4.0	7	3	6	4	3	4	4	3	5
8	BASELINE	6.22	7.0	2.22	7.0	8	9	7	4	2	8	6	5	7
9	BASELINE	4.00	4.0	1.58	4.0	6	4	5	3	2	5	6	2	3
10	BASELINE	8.44	9.0	1.24	4.0	9	8	9	6	9	9	10	7	9
11	MIXPRE	4.22	4.0	2.39	8.0	6	5	4	3	1	3	9	5	2
12	MIXPRE	3.67	4.0	1.80	5.0	6	4	6	5	1	4	2	3	2
14	MIXPRE	4.22	4.0	1.48	5.0	7	4	5	4	3	5	5	3	2
15	MIXPRE	5.00	5.0	2.50	7.0	7	3	7	5	2	7	8	5	1
16	MIXPRE	5.33	6.0	2.29	6.0	8	4	8	5	6	7	2	6	2
18	MIXPRE	4.56	4.0	1.59	5.0	8	4	5	4	4	6	3	4	3
19	MIXPRE	3.89	4.0	2.32	7.0	7	4	4	3	2	8	1	2	4
20	MIXPRE	4.33	3.0	2.06	5.0	7	3	4	7	3	7	2	3	3
21	MIXPRE	4.00	4.0	2.40	7.0	7	1	5	4	1	8	3	3	4
22	MIXPRE	4.11	4.0	1.83	6.0	8	2	5	4	2	4	4	3	5
23	MIXPRE	5.56	5.0	2.60	7.0	9	6	8	4	4	5	9	2	3
24	MIXPRE	7.67	8.0	1.32	4.0	8	9	9	8	5	8	8	6	8
25	MIXPOST	4.44	4.0	2.19	6.0	7	6	4	6	4	1	7	3	2
26	MIXPOST	5.00	4.0	1.87	5.0	7	4	8	5	3	4	3	4	7
27	MIXPOST	4.00	5.0	2.35	6.0	7	5	7	5	2	1	1	5	3
28	MIXPOST	5.78	5.0	2.05	5.0	8	5	7	5	3	8	8	3	5
29	MIXPOST	4.67	5.0	2.40	7.0	8	5	5	7	2	1	7	4	3
30	MIXPOST	5.44	6.0	1.33	4.0	6	6	7	5	3	7	6	5	4
31	MIXPOST	4.89	5.0	2.09	6.0	7	5	6	5	2	1	7	5	6
34	MIXPOST	5.00	4.0	1.87	5.0	8	4	4	4	3	4	8	4	6
35	MIXPOST	4.33	4.0	2.18	7.0	9	6	4	4	3	4	2	2	5

DISPLAY 3. CORRESPONDENCE AMONG OBSERVERS PAGE 1

1. REMOVALS

	NUMBER IN RAW DATA	EXCLUDED BY USER	REMOVED, TOO MANY BLANKS	REMOVED, POOR CORR. WITH GROUP	REMOVED, POOR RANGE OF RATINGS	REMAINDER INCLUDED
OBSERVERS	13	1	1	1	1	9
STIMULI	35	4	1			30

2. CORRELATION OF INDIVIDUAL OBSERVERS WITH GROUP (RATINGS)

	MIN	MEAN	MAX
ALL OBSERVERS AND STIMULI:	-.738	.324	.660
ONLY INCLUDED OBSERVERS AND STIMULI:	.299	.490	.647

3a. ANALYSIS OF VARIANCE (RATINGS)

GRAND MEAN: 4.9

SOURCE OF VARIATION	DF	SS	MS	F	SIGNIFICANCE LEVEL
MEAN	1	6404.54			
OBSERVERS	8	373.963	46.7454	19.1594	.501996E-21
STIMULI	29	306.463	10.5677	4.33135	.106622E-09
OBS. X STIM.	232	566.037	2.43981		
TOTAL	270	7651.00			

4a. RELIABILITY

OBSERVER TO OBSERVER	.270
GROUP TO GROUP	.769

3b. ANALYSIS OF VARIANCE (Z-SCORES)

GRAND MEAN: .0

SOURCE OF VARIATION	DF	SS	MS	F	SIGNIFICANCE LEVEL
MEAN	1	.104825E-11			
OBSERVERS	8	.117369E-11	.146711E-12	.214745E-12	1.00000
STIMULI	29	102.501	3.53451	5.17357	.216771E-12
OBS. X STIM.	232	158.499	.683186		
TOTAL	270	261.000			

4b. RELIABILITY

OBSERVER TO OBSERVER	.317
GROUP TO GROUP	.807

				TRANSFORMS BASED ON OBSERVERS RESPONSES TO								-- INDICATION OF NORMALITY --			
	------- RATING -------			ALL INCLUDED STIMULI			- BASELINE STIMULI -					SKEWNESS		KURTOSIS	MOD. A-D
STIMULUS	MEAN	MEDIAN	STD. DEV.	OAR	Z	LSR	OAR	Z	LSR	SBE	SBE*	RATING	Z	RATING	RATING
ALL STIM.	4.87	4.8	1.94	.00	.00	4.87	-.24	-.06	5.04	-8.25	-16.12	.100	.116	-1.265	.561
BASELINE	5.11	5.1	1.69	.24	.09	4.95	.00	.00	5.11	.00	.00	.029	.220	-1.335	.582
1	5.67	6.0	1.66	.80	.32	5.11	.56	.24	5.39	18.62	36.37	-.260	.077	-1.501	.454
2	4.11	4.0	1.90	-.76	-.32	4.64	-1.00	-.36	4.67	-36.00	-70.31	-.140	.011	-1.307	.179
3	3.78	3.0	1.09	-1.09	-.73	4.40	-1.33	-.81	4.13	-45.08	-88.03	.891	-.238	-.784	1.066
4	4.67	5.0	2.29	-.20	-.17	4.78	-.44	-.24	4.79	-15.35	-29.97	.142	.279	-1.793	.466
6	4.78	4.0	1.79	-.09	-.12	4.81	-.33	-.19	4.87	-10.12	-19.77	.295	.732	-1.869	.813
7	4.33	4.0	1.41	-.54	-.31	4.68	-.78	-.38	4.68	-25.84	-50.47	.655	.188	-1.111	.598
8	6.22	7.0	2.22	1.35	.71	5.36	1.11	.59	5.85	37.42	73.07	-.550	-.071	-1.070	.312
9	4.00	4.0	1.58	-.87	-.67	4.43	-1.11	-.70	4.27	-39.22	-76.60	.000	-.069	-1.791	.418
10	8.44	9.0	1.24	3.57	2.07	6.31	3.33	1.85	7.36	115.57	225.70	-.770	1.066	-.790	.930
ALL NON-BASELINE STIMULI	4.77	4.6	2.04	-.10	-.04	4.84	-.34	-.09	5.01	-11.79	-23.03	.131	.072	-1.235	.552
MIXPRE	4.71	4.6	2.05	-.16	-.08	4.80	-.40	-.13	4.96	-13.61	-26.58	.203	.230	-1.143	.537
11	4.22	4.0	2.39	-.65	-.52	4.52	-.89	-.53	4.42	-30.92	-60.38	.552	.748	-.710	.272
12	3.67	4.0	1.80	-1.20	-.67	4.41	-1.44	-.68	4.28	-50.30	-98.24	-.013	.272	-1.647	.297
14	4.22	4.0	1.48	-.65	-.40	4.60	-.89	-.44	4.58	-31.85	-62.20	.280	-.215	-.935	.341
15	5.00	5.0	2.50	.13	.03	4.85	-.11	.05	5.15	-6.62	-12.93	-.341	-.395	-1.629	.478
16	5.33	6.0	2.29	.46	.45	5.19	.22	.30	5.51	6.17	12.06	-.308	-.263	-1.551	.375
18	4.56	4.0	1.59	-.31	-.10	4.80	-.56	-.21	4.90	-17.98	-35.11	.988	.289	-.266	.774
19	3.89	4.0	2.32	-.98	-.63	4.44	-1.22	-.71	4.30	-40.63	-79.35	.549	.805	-1.163	.495
20	4.33	3.0	2.06	-.54	-.24	4.65	-.78	-.24	4.80	-23.79	-46.46	.440	.887	-1.807	1.124
21	4.00	4.0	2.40	-.87	-.55	4.46	-1.11	-.57	4.47	-38.29	-74.78	.290	.347	-1.313	.318
22	4.11	4.0	1.83	-.76	-.38	4.60	-1.00	-.43	4.64	-36.00	-70.30	.722	.215	-.332	.492
23	5.56	5.0	2.60	.69	.39	5.14	.44	.33	5.55	17.90	34.95	.171	-.168	-1.714	.378
24	7.67	8.0	1.32	2.80	1.64	5.97	2.56	1.54	6.94	88.97	173.75	-.896	.242	-.654	1.099
MIXPOST	4.84	4.7	2.04	-.03	.02	4.89	-.27	-.03	5.07	-9.36	-18.28	.034	-.140	-1.357	.571
25	4.44	4.0	2.19	-.43	-.20	4.73	-.67	-.22	4.78	-24.00	-46.86	-.189	-.033	-1.647	.356
26	5.00	4.0	1.87	.13	.13	4.99	-.11	.03	5.18	-2.26	-4.42	.407	.564	-1.658	.642
27	4.00	5.0	2.35	-.87	-.31	4.69	-1.11	-.39	4.64	-39.86	-77.84	-.052	-.248	-1.736	.469
28	5.78	5.0	2.05	.91	.44	5.15	.67	.41	5.62	22.97	44.86	-.123	-.396	-1.765	.629
29	4.67	5.0	2.40	-.20	.02	4.84	-.44	.05	5.12	-16.28	-31.79	-.086	.285	-1.582	.243
30	5.44	6.0	1.33	.57	.23	5.04	.33	.17	5.29	11.25	21.97	-.457	-1.29 1	-1.167	.394
31	4.89	5.0	2.09	.02	.04	4.91	-.22	-.02	5.07	-10.28	-20.08	-.749	-.712	-1.007	.711
34	5.00	4.0	1.87	.13	.04	4.89	-.11	-.03	5.09	.96	1.88	.713	.013	-1.331	1.205
35	4.33	4.0	2.18	-.54	-.19	4.74	-.78	-.30	4.81	-26.77	-52.27	.844	.556	-.318	.494

DISPLAY 5. DISTRIBUTION OF RATINGS

1. PROPORTIONS OF OBSERVERS USING RANGE OF RATINGS

RANGE:	9	8	7	6	5	4	3	2	1	0
PROPORTION:	.111	.444	.000	.111	.222	.000	.111	.000	.000	.000

2. PROPORTIONS OF RESPONSES IN EACH OF THE FOLLOWING RATING CATEGORIES:

	1	2	3	4	5	6	7	8	9	10
ALL STIM.	.044	.093	.163	.181	.148	.100	.130	.093	.044	.004
BASELINE	.012	.074	.210	.160	.123	.123	.148	.062	.074	.012
1	.000	.000	.111	.222	.000	.333	.222	.111	.000	.000
2	.111	.111	.111	.222	.222	.111	.111	.000	.000	.000
3	.000	.000	.556	.222	.111	.111	.000	.000	.000	.000
4	.000	.222	.222	.000	.222	.000	.222	.111	.000	.000
6	.000	.000	.333	.222	.111	.000	.333	.000	.000	.000
7	.000	.000	.333	.333	.111	.111	.111	.000	.000	.000
8	.000	.111	.000	.111	.111	.111	.222	.222	.111	.000
9	.000	.222	.222	.111	.222	.222	.000	.000	.000	.000
10	.000	.000	.000	.000	.000	.111	.111	.111	.556	.111
MIXPRE	.056	.120	.157	.194	.139	.074	.093	.120	.046	.000
11	.111	.111	.222	.111	.222	.111	.000	.000	.111	.000
12	.111	.222	.111	.222	.111	.222	.000	.000	.000	.000
14	.000	.111	.222	.222	.333	.000	.111	.000	.000	.000
15	.111	.111	.111	.000	.222	.000	.333	.111	.000	.000
16	.000	.222	.000	.111	.111	.222	.111	.222	.000	.000
18	.000	.000	.222	.444	.111	.111	.000	.111	.000	.000
19	.111	.222	.111	.333	.000	.000	.111	.111	.000	.000
20	.000	.111	.444	.111	.000	.000	.333	.000	.000	.000
21	.222	.000	.222	.222	.111	.000	.111	.111	.000	.000
22	.000	.222	.111	.333	.222	.000	.000	.111	.000	.000
23	.000	.111	.111	.222	.111	.111	.000	.111	.222	.000
24	.000	.000	.000	.000	.111	.111	.000	.556	.222	.000
MIXPOST	.062	.074	.123	.185	.185	.111	.160	.086	.012	.000
25	.111	.111	.111	.222	.000	.222	.222	.000	.000	.000
26	.000	.000	.222	.333	.111	.000	.222	.111	.000	.000
27	.222	.111	.111	.000	.333	.000	.222	.000	.000	.000
28	.000	.000	.222	.000	.333	.000	.111	.333	.000	.000
29	.111	.111	.111	.111	.222	.000	.222	.111	.000	.000
30	.000	.000	.111	.111	.222	.333	.222	.000	.000	.000
31	.111	.111	.000	.000	.333	.222	.222	.000	.000	.000
34	.000	.000	.111	.556	.000	.111	.000	.222	.000	.000
35	.000	.222	.111	.333	.111	.111	.000	.000	.111	.000

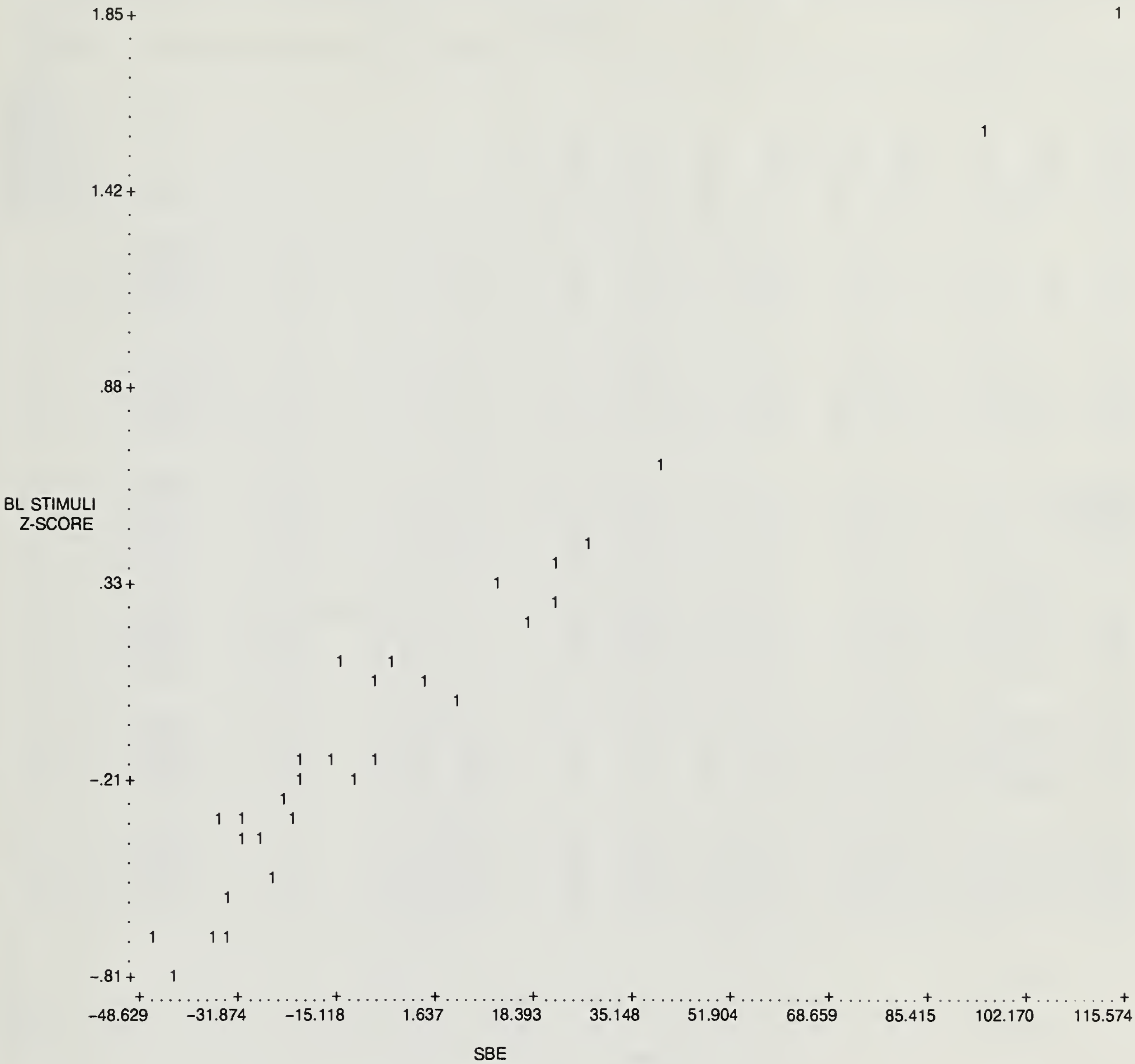
DISPLAY 6. STIMULUS-LEVEL CORRELATION DISPLAY PAGE 1

		TRANSFORMS BASED ON OBSERVERS' RESPONSES TO 1) ALL INCLUDED STIMULI		2) BASELINE STIMULI		
STIMULUS	RATING	Z	LSR	Z	LSR	SBE
ALL STIM. Z-SCORE	.988					
ALL STIM. LSR	.989	.999				
BL STIMULI Z-SCORE	.988	.998	.994			
BL STIMULI LSR	.987	.998	.995	.999		
SBE	.999	.987	.987	.986	.986	

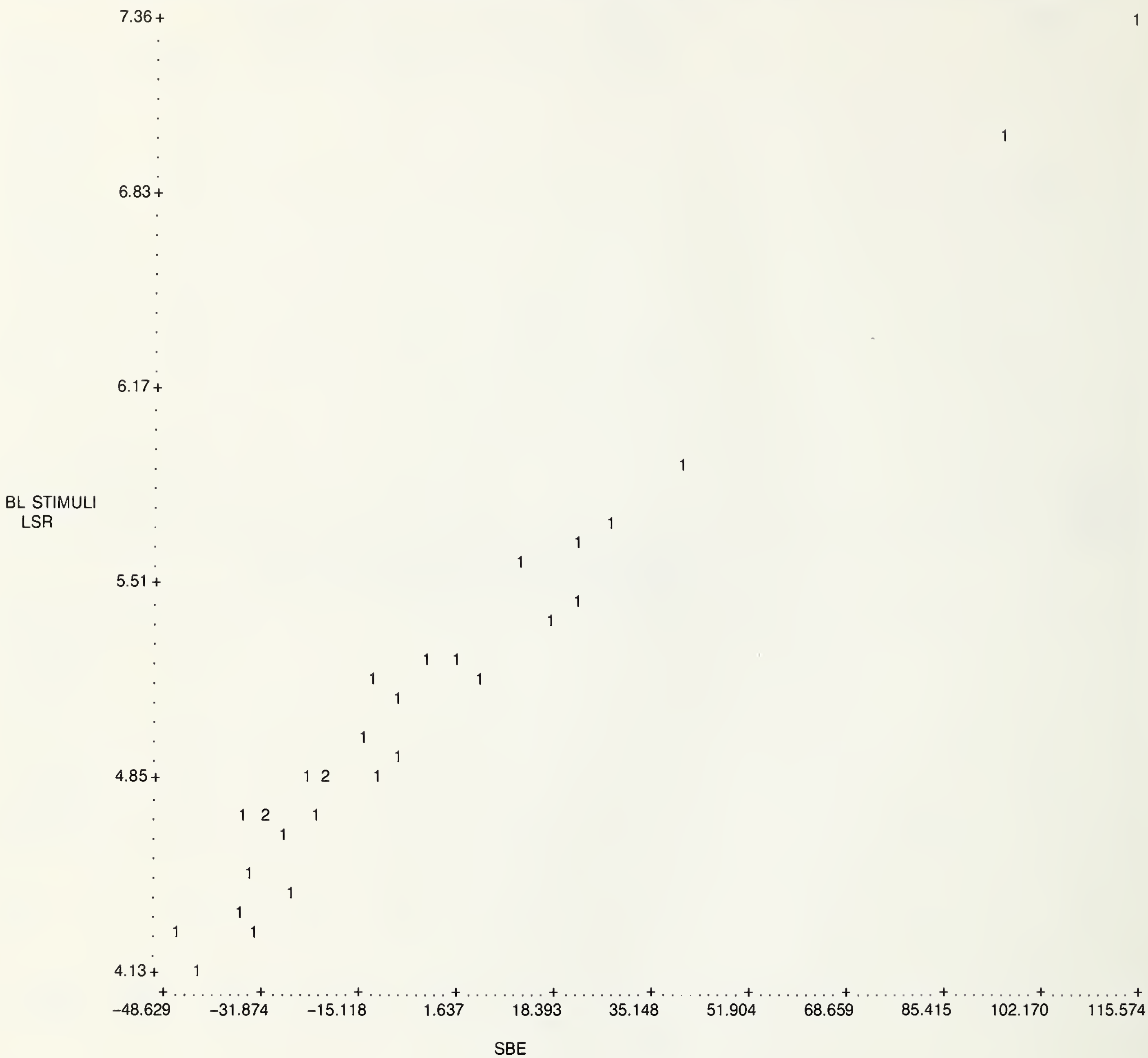
DISPLAY 7. CONDITION-LEVEL CORRELATION DISPLAY PAGE 1

		TRANSFORMS BASED ON OBSERVERS' RESPONSES TO 1) ALL INCLUDED STIMULI		2) BASELINE STIMULI		
STIMULUS	RATING	Z	LSR	Z	LSR	SBE
ALL STIM. Z-SCORE	.989					
ALL STIM. LSR	.946	.984				
BL STIMULI Z-SCORE	.959	.991	.999			
BL STIMULI LSR	.923	.970	.998	.994		
SBE	.976	.932	.853	.874	.816	

DISPLAY 8. SCATTERGRAM OF TWO OUTPUT MEASURES (CORRELATION LESS THAN .986) PAGE 1



DISPLAY 8. SCATTERGRAM OF TWO OUTPUT MEASURES (CORRELATION LESS THAN .986)



SAMPLE RUNSTREAM 06-07-90 13:49:47

DISPLAY 9. Z-SCORES AND ASSOCIATED STATISTICS PAGE 1

STIMULUS	CONDITION	MEAN	MED.	STD. DEV.	RANGE	OBSERVERS: 1	2	4	5	6	7	8	10	12
MEAN						.00	.00	.00	.00	.00	.00	.00	.00	.00
MEDIAN														
STANDARD DEVIATION						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
RANGE						3.4	4.2	3.7	4.0	5.0	3.3	3.3	3.8	3.9
SKEWNESS						.303	.387	.363	.859	1.925	−.069	−.128	.350	.579
CORRELATION W/ GROUP						.481	.557	.668	.403	.680	.324	.348	.519	.541
SIGNIFICANCE OF R						.004	.001	.000	.014	.000	.040	.030	.002	.001
1	BASELINE	.32		.58	1.6	−.34	1.09	.12	−.48	.04	.45	.96	.08	.95
2	BASELINE	−.32		.69	2.3	−.34	−.49	.12	.32	−.58	−.37	−.89	.83	−1.51
3	BASELINE	−.73		.65	1.8	−1.48	−.49	−1.74	−1.28	.04	−.78	−.15	−.68	−.03
4	BASELINE	−.17		.91	2.4	−.34	1.09	−.50	−1.28	−.58	−1.20	.96	.83	−.52
6	BASELINE	−.12		.62	1.9	−.34	1.09	−.50	−.48	.04	−.78	.59	−.68	−.03
7	BASELINE	−.31		.45	1.5	−.34	−1.02	.12	−.48	.04	−.37	−.52	−.68	.46
8	BASELINE	.71		.89	2.7	.80	2.15	.75	−.48	−.58	1.28	.22	.83	1.44
9	BASELINE	−.67		.61	1.7	−1.48	−.49	−.50	−1.28	−.58	.04	.22	−1.44	−.52
10	BASELINE	2.07		.76	2.7	1.94	1.62	1.99	1.12	3.80	1.69	1.70	2.34	2.43
11	MIXPRE	−.52		1.01	2.8	−1.48	.04	−1.12	−1.28	−1.21	−.78	1.33	.83	−1.02
12	MIXPRE	−.67		.63	1.8	−1.48	−.49	.12	.32	−1.21	−.37	−1.26	−.68	−1.02
14	MIXPRE	−.40		.34	1.1	−.34	−.49	−.50	−.48	.04	.04	−.15	−.68	−1.02
15	MIXPRE	.03		.92	2.5	−.34	−1.02	.75	.32	−.58	.87	.96	.83	−1.51
16	MIXPRE	.45		1.15	3.2	.80	−.49	1.37	.32	1.92	.87	−1.26	1.59	−1.02
18	MIXPRE	−.10		.61	1.7	.80	−.49	−.50	−.48	.67	.45	−.89	.08	−.52
19	MIXPRE	−.63		.90	2.9	−.34	−.49	−1.12	−1.28	−.58	1.28	−1.63	−1.44	−.03
20	MIXPRE	−.24		1.04	3.2	−.34	−1.02	−1.12	1.92	.04	.87	−1.26	−.68	−.52
21	MIXPRE	−.55		.91	3.4	−.34	−2.08	−.50	−.48	−1.21	1.28	−.89	−.68	−.03
22	MIXPRE	−.38		.67	2.3	.80	−1.55	−.50	−.48	−.58	−.37	−.52	−.68	.46
23	MIXPRE	.39		1.08	3.4	1.94	.56	1.37	−.48	.67	.04	1.33	−1.44	−.52
24	MIXPRE	1.64		.62	1.9	.80	2.15	1.99	2.72	1.29	1.28	.96	1.59	1.93
25	MIXPOST	−.20		.97	2.7	−.34	.56	−1.12	1.12	.67	−1.61	.59	−.68	−1.02
26	MIXPOST	.13		.81	2.3	−.34	−.49	1.37	.32	.04	−.37	−.89	.08	1.44
27	MIXPOST	−.31		.90	2.5	−.34	.04	.75	.32	−.58	−1.61	−1.63	.83	−.52
28	MIXPOST	.44		.59	2.0	.80	.04	.75	.32	.04	1.28	.96	−.68	.46
29	MIXPOST	.02		1.01	3.5	.80	.04	−.50	1.92	−.58	−1.61	.59	.08	−.52
30	MIXPOST	.23		.72	2.3	−1.48	.56	.75	.32	.04	.87	.22	.83	−.03
31	MIXPOST	.04		.80	2.6	−.34	.04	.12	.32	−.58	−1.61	.59	.83	.95
34	MIXPOST	.04		.74	2.1	.80	−.49	−1.12	−.48	.04	−.37	.96	.08	.95
35	MIXPOST	−.19		1.08	3.4	1.94	.56	−1.12	−.48	.04	−.37	−1.26	−1.44	.46

DISPLAY 10. LEAST SQUARES RATINGS AND ASSOCIATED STATISTICS

STIMULUS	CONDITION	MEAN	MED.	STD. DEV.	RANGE	OBSERVERS: 1	2	4	5	6	7	8	10	12
MEAN						4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87
MEDIAN														
STANDARD DEVIATION						.59	.75	.79	.51	.80	.56	.63	.67	.74
RANGE						2.0	3.2	3.0	2.0	4.0	1.8	2.1	2.5	2.9
SKEWNESS						.303	.387	.363	.859	1.925	-.069	-.128	.350	.579
CORRELATION W/ GROUP						.488	.565	.658	.410	.671	.336	.365	.528	.544
SIGNIFICANCE OF R						.003	.001	.000	.012	.000	.035	.024	.001	.001
1	BASELINE	5.11		.39	1.1	4.67	5.69	4.97	4.63	4.90	5.12	5.47	4.92	5.57
2	BASELINE	4.64		.48	1.7	4.67	4.50	4.97	5.03	4.40	4.66	4.31	5.42	3.76
3	BASELINE	4.40		.45	1.4	3.99	4.50	3.49	4.22	4.90	4.43	4.78	4.42	4.85
4	BASELINE	4.78		.58	1.5	4.67	5.69	4.47	4.22	4.40	4.20	5.47	5.42	4.48
6	BASELINE	4.81		.42	1.3	4.67	5.69	4.47	4.63	4.90	4.43	5.24	4.42	4.85
7	BASELINE	4.68		.32	1.1	4.67	4.10	4.97	4.63	4.90	4.66	4.54	4.42	5.21
8	BASELINE	5.36		.64	2.1	5.34	6.49	5.46	4.63	4.40	5.59	5.01	5.42	5.94
9	BASELINE	4.43		.36	1.1	3.99	4.50	4.47	4.22	4.40	4.89	5.01	3.91	4.48
10	BASELINE	6.31		.70	2.5	6.02	6.09	6.45	5.44	7.91	5.82	5.94	6.43	6.66
11	MIXPRE	4.52		.67	1.8	3.99	4.90	3.98	4.22	3.90	4.43	5.71	5.42	4.12
12	MIXPRE	4.41		.42	1.1	3.99	4.50	4.97	5.03	3.90	4.66	4.08	4.42	4.12
14	MIXPRE	4.60		.25	.8	4.67	4.50	4.47	4.63	4.90	4.89	4.78	4.42	4.12
15	MIXPRE	4.85		.65	1.7	4.67	4.10	5.46	5.03	4.40	5.35	5.47	5.42	3.76
16	MIXPRE	5.19		.83	2.3	5.34	4.50	5.96	5.03	6.40	5.35	4.08	5.93	4.12
18	MIXPRE	4.80		.41	1.1	5.34	4.50	4.47	4.63	5.40	5.12	4.31	4.92	4.48
19	MIXPRE	4.44		.55	1.7	4.67	4.50	3.98	4.22	4.40	5.59	3.85	3.91	4.85
20	MIXPRE	4.65		.63	1.9	4.67	4.10	3.98	5.85	4.90	5.35	4.08	4.42	4.48
21	MIXPRE	4.46		.63	2.3	4.67	3.30	4.47	4.63	3.90	5.59	4.31	4.42	4.85
22	MIXPRE	4.60		.48	1.6	5.34	3.70	4.47	4.63	4.40	4.66	4.54	4.42	5.21
23	MIXPRE	5.14		.72	2.1	6.02	5.30	5.96	4.63	5.40	4.89	5.71	3.91	4.48
24	MIXPRE	5.97		.43	1.1	5.34	6.49	6.45	6.26	5.90	5.59	5.47	5.93	6.30
25	MIXPOST	4.73		.63	1.5	4.67	5.30	3.98	5.44	5.40	3.97	5.24	4.42	4.12
26	MIXPOST	4.99		.59	1.6	4.67	4.50	5.96	5.03	4.90	4.66	4.31	4.92	5.94
27	MIXPOST	4.69		.58	1.6	4.67	4.90	5.46	5.03	4.40	3.97	3.85	5.42	4.48
28	MIXPOST	5.15		.37	1.2	5.34	4.90	5.46	5.03	4.90	5.59	5.47	4.42	5.21
29	MIXPOST	4.84		.58	1.9	5.34	4.90	4.47	5.85	4.40	3.97	5.24	4.92	4.48
30	MIXPOST	5.04		.45	1.5	3.99	5.30	5.46	5.03	4.90	5.35	5.01	5.42	4.85
31	MIXPOST	4.91		.50	1.6	4.67	4.90	4.97	5.03	4.40	3.97	5.24	5.42	5.57
34	MIXPOST	4.89		.51	1.6	5.34	4.50	3.98	4.63	4.90	4.66	5.47	4.92	5.57
35	MIXPOST	4.74		.70	2.1	6.02	5.30	3.98	4.63	4.90	4.66	4.08	3.91	5.21

DISPLAY 11. BASELINE-ADJUSTED Z-SCORES AND ASSOCIATED STATISTICS

STIMULUS	CONDITION	MEAN	MED.	STD. DEV.	RANGE	OBSERVERS: 1	2	4	5	6	7	8	10	12
MEAN						.20	−.44	.01	.60	−.13	.00	−.43	−.14	−.25
MEDIAN														
STANDARD DEVIATION						.94	.88	.98	1.25	.72	1.02	1.24	.86	.85
RANGE						3.2	3.7	3.7	5.0	3.6	3.4	4.1	3.3	3.3
SKEWNESS						.303	.387	.363	.859	1.925	−.069	−.128	.350	.579
CORRELATION W/ GROUP						.468	.560	.665	.389	.676	.305	.330	.527	.533
SIGNIFICANCE OF R						.005	.001	.000	.017	.000	.051	.037	.001	.001
1	BASELINE	.24		.34	.9	−.12	.52	.14	.00	−.10	.47	.76	−.07	.56
2	BASELINE	−.36		.87	2.5	−.12	−.88	.14	1.00	−.55	−.38	−1.53	.58	−1.53
3	BASELINE	−.81		.47	1.6	−1.20	−.88	−1.69	−1.00	−.10	−.80	−.61	−.72	−.28
4	BASELINE	−.24		.72	2.0	−.12	.52	−.47	−1.00	−.55	−1.22	.76	.58	−.70
6	BASELINE	−.19		.44	1.3	−.12	.52	−.47	.00	−.10	−.80	.31	−.72	−.28
7	BASELINE	−.38		.54	1.5	−.12	−1.35	.14	.00	−.10	−.38	−1.07	−.72	.14
8	BASELINE	.59		.69	2.0	.96	1.45	.74	.00	−.55	1.31	−.15	.58	.97
9	BASELINE	−.70		.47	1.4	−1.20	−.88	−.47	−1.00	−.55	.05	−.15	−1.37	−.70
10	BASELINE	1.85		.42	1.6	2.04	.98	1.96	2.00	2.60	1.74	1.68	1.88	1.81
11	MIXPRE	−.53		.86	2.4	−1.20	−.41	−1.08	−1.00	−1.00	−.80	1.22	.58	−1.11
12	MIXPRE	−.68		.86	3.0	−1.20	−.88	.14	1.00	−1.00	−.38	−1.99	−.72	−1.11
14	MIXPRE	−.44		.42	1.2	−.12	−.88	−.47	.00	−.10	.05	−.61	−.72	−1.11
15	MIXPRE	.05		.98	2.5	−.12	−1.35	.74	1.00	−.55	.89	.76	.58	−1.53
16	MIXPRE	.30		1.26	3.3	.96	−.88	1.35	1.00	1.25	.89	−1.99	1.23	−1.11
18	MIXPRE	−.21		.77	2.5	.96	−.88	−.47	.00	.35	.47	−1.53	−.07	−.70
19	MIXPRE	−.71		1.02	3.8	−.12	−.88	−1.08	−1.00	−.55	1.31	−2.45	−1.37	−.28
20	MIXPRE	−.24		1.47	5.0	−.12	−1.35	−1.08	3.00	−.10	.89	−1.99	−.72	−.70
21	MIXPRE	−.57		1.01	3.6	−.12	−2.28	−.47	.00	−1.00	1.31	−1.53	−.72	−.28
22	MIXPRE	−.43		.78	2.8	.96	−1.81	−.47	.00	−.55	−.38	−1.07	−.72	.14
23	MIXPRE	.33		1.06	3.4	2.04	.05	1.35	.00	.35	.05	1.22	−1.37	−.70
24	MIXPRE	1.54		.99	3.2	.96	1.45	1.96	4.00	.80	1.31	.76	1.23	1.39
25	MIXPOST	−.22		1.09	3.6	−.12	.05	−1.08	2.00	.35	−1.64	.31	−.72	−1.11
26	MIXPOST	.03		.94	2.9	−.12	−.88	1.35	1.00	−.10	−.38	−1.53	−.07	.97
27	MIXPOST	−.39		1.13	3.4	−.12	−.41	.74	1.00	−.55	−1.64	−2.45	.58	−.70
28	MIXPOST	.41		.71	2.0	.96	−.41	.74	1.00	−.10	1.31	.76	−.72	.14
29	MIXPOST	.05		1.32	4.6	.96	−.41	−.47	3.00	−.55	−1.64	.31	−.07	−.70
30	MIXPOST	.17		.70	2.2	−1.20	.05	.74	1.00	−.10	.89	−.15	.58	−.28
31	MIXPOST	−.02		.79	2.6	−.12	−.41	.14	1.00	−.55	−1.64	.31	.58	.56
34	MIXPOST	−.03		.70	2.0	.96	−.88	−1.08	.00	−.10	−.38	.76	−.07	.56
35	MIXPOST	−.30		1.15	4.0	2.04	.05	−1.08	.00	−.10	−.38	−1.99	−1.37	.14

DISPLAY 12. BASELINE-ADJUSTED LEAST SQUARES RATINGS AND ASSOCIATED STATISTICS

				STD.		OBSERVERS:								
STIMULUS	CONDITION	MEAN	MED.	DEV.	RANGE	1	2	4	5	6	7	8	10	12
MEAN						5.39	4.62	5.13	5.75	4.95	5.12	4.64	4.95	4.79
MEDIAN														
STANDARD DEVIATION						1.30	.97	1.27	1.34	.87	1.28	1.36	1.00	1.10
RANGE						4.5	4.1	4.7	5.3	4.3	4.2	4.5	3.8	4.3
SKEWNESS						.303	.387	.363	.859	1.925	-.069	-.128	.350	.579
CORRELATION W/ GROUP						.473	.555	.665	.393	.683	.319	.326	.517	.538
SIGNIFICANCE OF R						.004	.001	.000	.016	.000	.043	.039	.002	.001
1	BASELINE	5.39		.40	1.0	4.95	5.68	5.29	5.11	4.99	5.70	5.95	5.03	5.83
2	BASELINE	4.67		1.01	3.1	4.95	4.14	5.29	6.18	4.45	4.64	3.43	5.79	3.13
3	BASELINE	4.13		.63	2.1	3.46	4.14	2.92	4.04	4.99	4.12	4.44	4.27	4.75
4	BASELINE	4.79		.84	2.4	4.95	5.68	4.50	4.04	4.45	3.59	5.95	5.79	4.21
6	BASELINE	4.87		.52	1.6	4.95	5.68	4.50	5.11	4.99	4.12	5.45	4.27	4.75
7	BASELINE	4.68		.61	1.7	4.95	3.62	5.29	5.11	4.99	4.64	3.94	4.27	5.29
8	BASELINE	5.85		.83	2.3	6.43	6.71	6.08	5.11	4.45	6.75	4.94	5.79	6.37
9	BASELINE	4.27		.58	1.7	3.46	4.14	4.50	4.04	4.45	5.17	4.94	3.51	4.21
10	BASELINE	7.36		.58	2.0	7.91	6.20	7.65	7.25	8.24	7.28	6.96	7.30	7.46
11	MIXPRE	4.42		1.03	3.0	3.46	4.65	3.71	4.04	3.91	4.12	6.45	5.79	3.67
12	MIXPRE	4.28		.99	3.2	3.46	4.14	5.29	6.18	3.91	4.64	2.93	4.27	3.67
14	MIXPRE	4.58		.51	1.5	4.95	4.14	4.50	5.11	4.99	5.17	4.44	4.27	3.67
15	MIXPRE	5.15		1.18	3.1	4.95	3.62	6.08	6.18	4.45	6.22	5.95	5.79	3.13
16	MIXPRE	5.51		1.49	3.9	6.43	4.14	6.86	6.18	6.62	6.22	2.93	6.54	3.67
18	MIXPRE	4.90		.92	3.0	6.43	4.14	4.50	5.11	5.53	5.70	3.43	5.03	4.21
19	MIXPRE	4.30		1.18	4.3	4.95	4.14	3.71	4.04	4.45	6.75	2.43	3.51	4.75
20	MIXPRE	4.80		1.63	5.4	4.95	3.62	3.71	8.32	4.99	6.22	2.93	4.27	4.21
21	MIXPRE	4.47		1.17	4.2	4.95	2.59	4.50	5.11	3.91	6.75	3.43	4.27	4.75
22	MIXPRE	4.64		.93	3.3	6.43	3.11	4.50	5.11	4.45	4.64	3.94	4.27	5.29
23	MIXPRE	5.55		1.35	4.4	7.91	5.17	6.86	5.11	5.53	5.17	6.45	3.51	4.21
24	MIXPRE	6.94		1.05	3.4	6.43	6.71	7.65	9.39	6.07	6.75	5.95	6.54	6.91
25	MIXPOST	4.78		1.27	4.2	4.95	5.17	3.71	7.25	5.53	3.06	5.45	4.27	3.67
26	MIXPOST	5.18		1.11	3.4	4.95	4.14	6.86	6.18	4.99	4.64	3.43	5.03	6.37
27	MIXPOST	4.64		1.30	3.8	4.95	4.65	6.08	6.18	4.45	3.06	2.43	5.79	4.21
28	MIXPOST	5.62		.85	2.5	6.43	4.65	6.08	6.18	4.99	6.75	5.95	4.27	5.29
29	MIXPOST	5.12		1.51	5.3	6.43	4.65	4.50	8.32	4.45	3.06	5.45	5.03	4.21
30	MIXPOST	5.29		.89	2.8	3.46	5.17	6.08	6.18	4.99	6.22	4.94	5.79	4.75
31	MIXPOST	5.07		.94	3.1	4.95	4.65	5.29	6.18	4.45	3.06	5.45	5.79	5.83
34	MIXPOST	5.09		.87	2.7	6.43	4.14	3.71	5.11	4.99	4.64	5.95	5.03	5.83
35	MIXPOST	4.81		1.44	5.0	7.91	5.17	3.71	5.11	4.99	4.64	2.93	3.51	5.29

SAMPLE RUNSTREAM 06-07-90 13:49:47

DISPLAY 13. PRINCIPAL COMPONENT ANALYSIS: EIGENVALUES PAGE 1

EIGENVALUES:

3.634	1.262	1.083	.8305	.5924	.4970	.4131	.3950	.2926

PERCENT OF VARIANCE:

40.38	14.02	12.04	9.228	6.582	5.522	4.590	4.389	3.251

SAMPLE RUNSTREAM 06-07-90 13:49:47

DISPLAY 14. PRINCIPAL COMPONENT ANALYSIS: COMPONENT LOADINGS PAGE 1

OBSERVER	COMPONENT 1	COMPONENT 2	COMPONENT 3
1	.613 *	−.271	.385
2	.678 *	.503	.146
4	.775 *	−.167	−.275
5	.540	−.168	−.556 *
6	.785 *	−.184	.075
7	.451	−.588 *	.208
8	.473	.677 *	.198
10	.652 *	.204	−.521
12	.662 *	.000	.411

* OBSERVER'S STRONGEST LOADING

SAMPLE RUNSTREAM 06-07-90 13:49:47

DISPLAY 15. PRINCIPAL COMPONENT ANALYSIS: COMPONENT SCORES PAGE 1

STIMULUS	COMPONENT 1	COMPONENT 2	COMPONENT 3
1	.169	.181	.161
2	−.173	−.056	−.315 L
3	−.403 L	.144	.125
4	−.087	.425 H	.022
6	−.060	.251	.130
7	−.154	−.106	.057
8	.388	.082	.198
9	−.384 L	.065	.134
10	1.181 H	−.048	.100
11	−.316	.426 H	−.069
12	−.371	−.078	−.238
14	−.227	−.044	.021
15	−.021	−.030	−.248
16	.298	−.353 L	−.266
18	−.047	−.211	.063
19	−.362	−.297	.259
20	−.165	−.342 L	−.173
21	−.344	−.340	.055
22	−.216	−.165	.144
23	.220	.012	.281 H
24	.908 H	.011	−.164
25	−.110	.241	−.106
26	.111	−.135	−.081
27	−.116	.008	−.332 L
28	.213	−.103	.166
29	−.003	.170	−.203
30	.124	.051	−.195
31	.034	.274	−.115
34	.003	.113	.228
35	−.090	−.150	.360 H

H = HIGHEST TWO STIMULI ON COMPONENT
L = LOWEST TWO STIMULI ON COMPONENT

SAMPLE RUNSTREAM 06-07-90 13:49:47

DISPLAY 16. PRINCIPAL COMPONENT ANALYSIS: LEGEND FOR SCATTERGRAM (NEXT PAGE)
OF COMPONENT LOADINGS

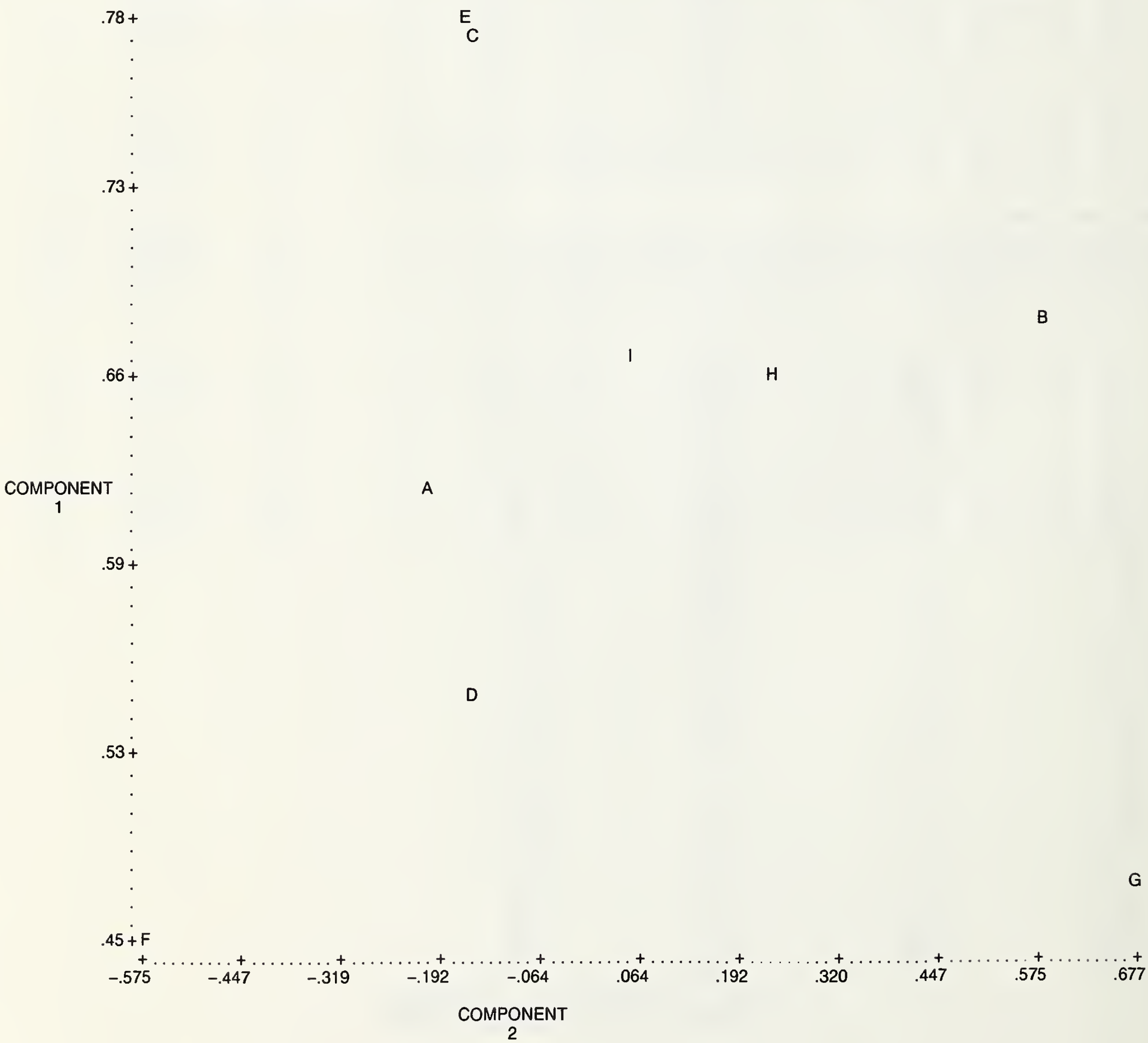
PAGE 1

OBSERVER	SYMBOL	COMPONENT 1	COMPONENT 2
1	A	.613	−.271
2	B	.678	.503
4	C	.775	−.167
5	D	.540	−.168
6	E	.785	−.184
7	F	.451	−.588
8	G	.473	.677
10	H	.652	.204
12	I	.662	.000

SAMPLE RUNSTREAM 06-07-90 13:49:47

DISPLAY 16. PRINCIPAL COMPONENT ANALYSIS: SCATTERGRAM (LEGEND ON PREVIOUS PAGE)
OF COMPONENT LOADINGS

PAGE 2

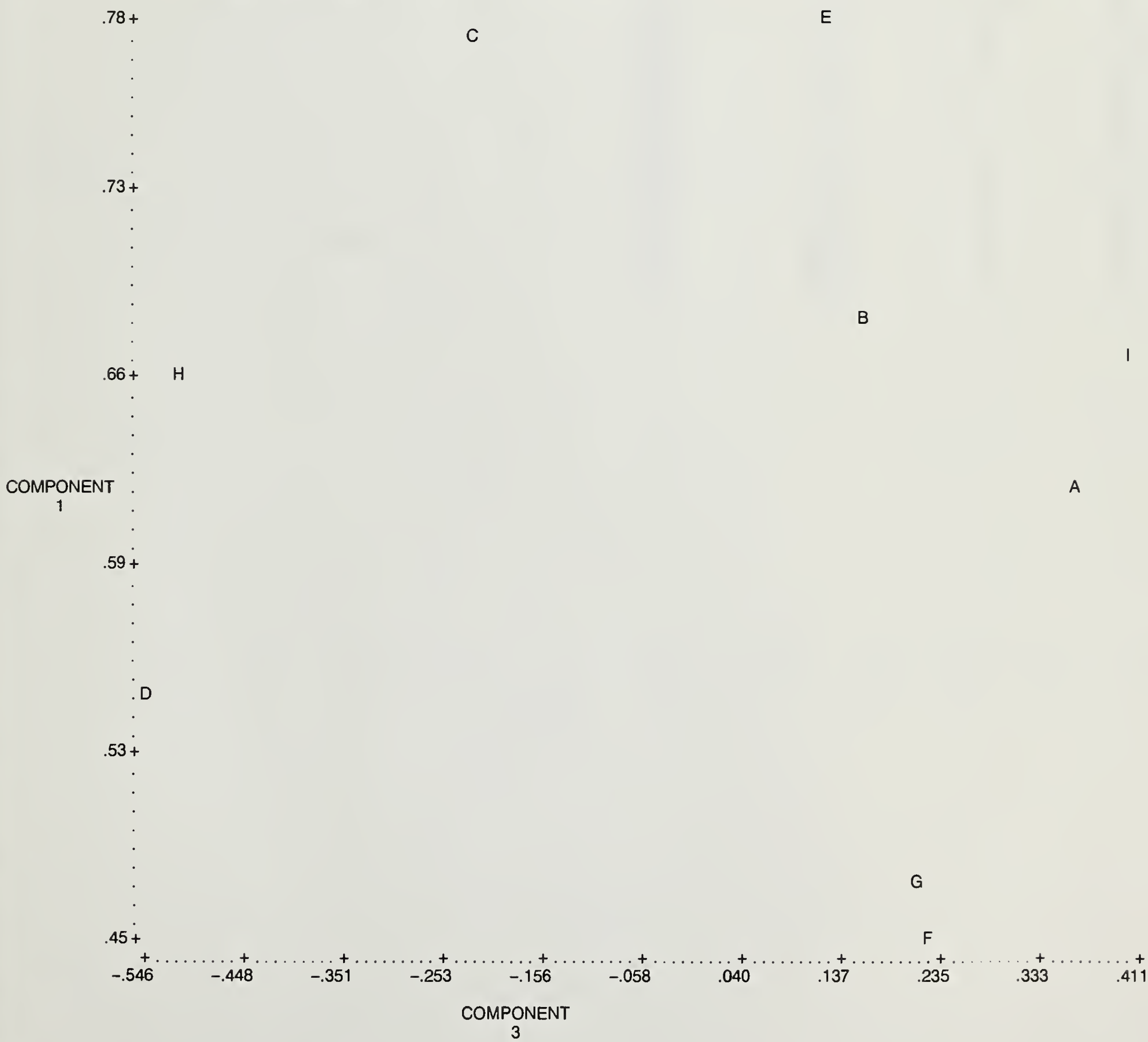


DISPLAY 16. PRINCIPAL COMPONENT ANALYSIS: LEGEND FOR SCATTERGRAM (NEXT PAGE) OF COMPONENT LOADINGS

OBSERVER	SYMBOL	COMPONENT 1	COMPONENT 3
1	A	.613	.385
2	B	.678	.146
4	C	.775	−.275
5	D	.540	−.556
6	E	.785	.075
7	F	.451	.208
8	G	.473	.198
10	H	.652	−.521
12	I	.662	.411

SAMPLE RUNSTREAM 06-07-90 13:49:47

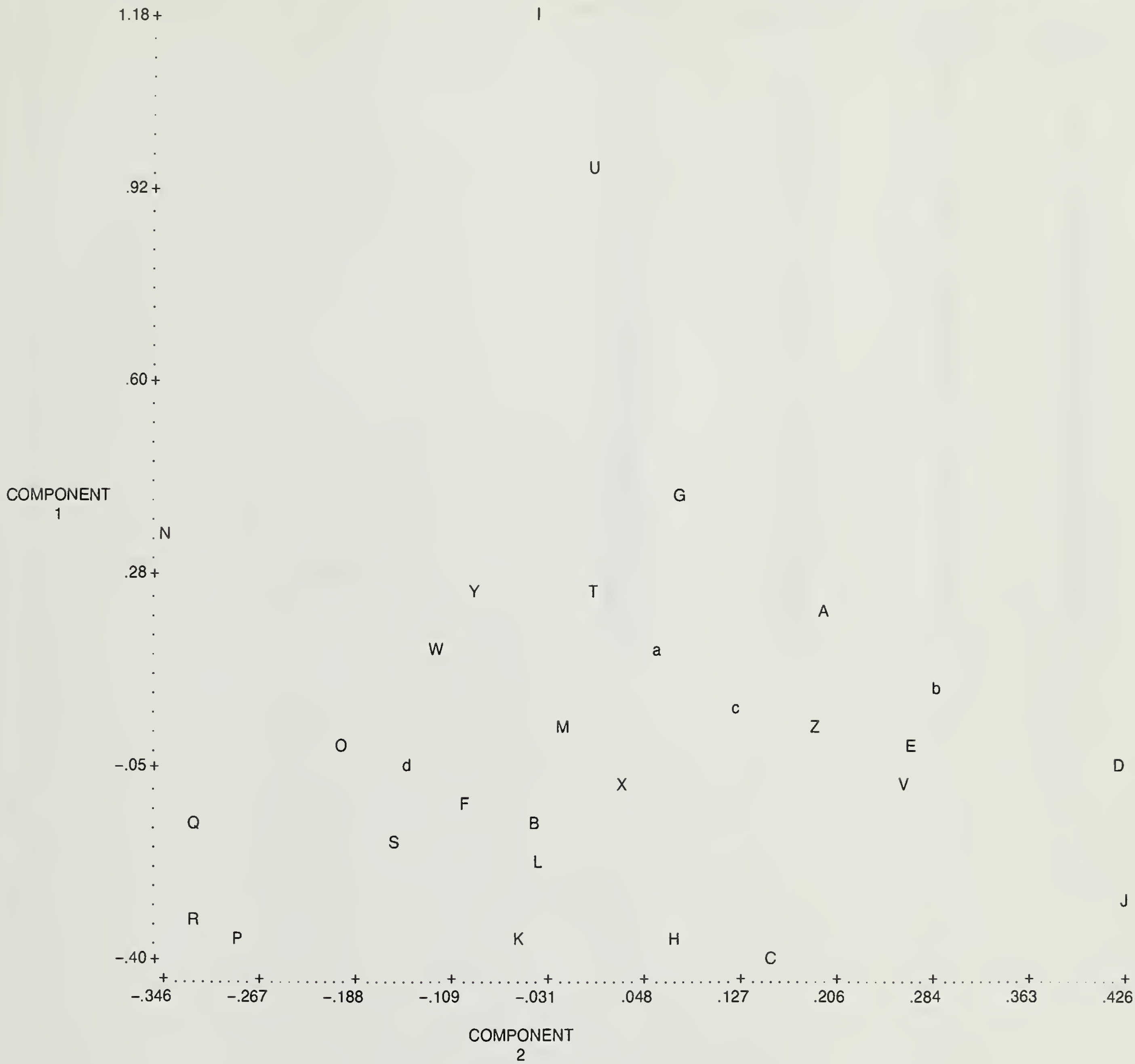
DISPLAY 16. PRINCIPAL COMPONENT ANALYSIS: SCATTERGRAM (LEGEND ON PREVIOUS PAGE) OF COMPONENT LOADINGS



DISPLAY 17. PRINCIPAL COMPONENT ANALYSIS: LEGEND FOR SCATTERGRAM (NEXT PAGE) OF COMPONENT SCORES

STIMULUS	SYMBOL	COMPONENT 1	COMPONENT 2
1	A	.169	.181
2	B	−.173	−.056
3	C	−.403	.144
4	D	−.087	.425
6	E	−.060	.251
7	F	−.154	−.106
8	G	.388	.082
9	H	−.384	.065
10	I	1.181	−.048
11	J	−.316	.426
12	K	−.371	−.078
14	L	−.227	−.044
15	M	−.021	−.030
16	N	.298	−.353
18	O	−.047	−.211
19	P	−.362	−.297
20	Q	−.165	−.342
21	R	−.344	−.340
22	S	−.216	−.165
23	T	.220	.012
24	U	.908	.011
25	V	−.110	.241
26	W	.111	−.135
27	X	−.116	.008
28	Y	.213	−.103
29	Z	−.003	.170
30	a	.124	.051
31	b	.034	.274
34	c	.003	.113
35	d	−.090	−.150

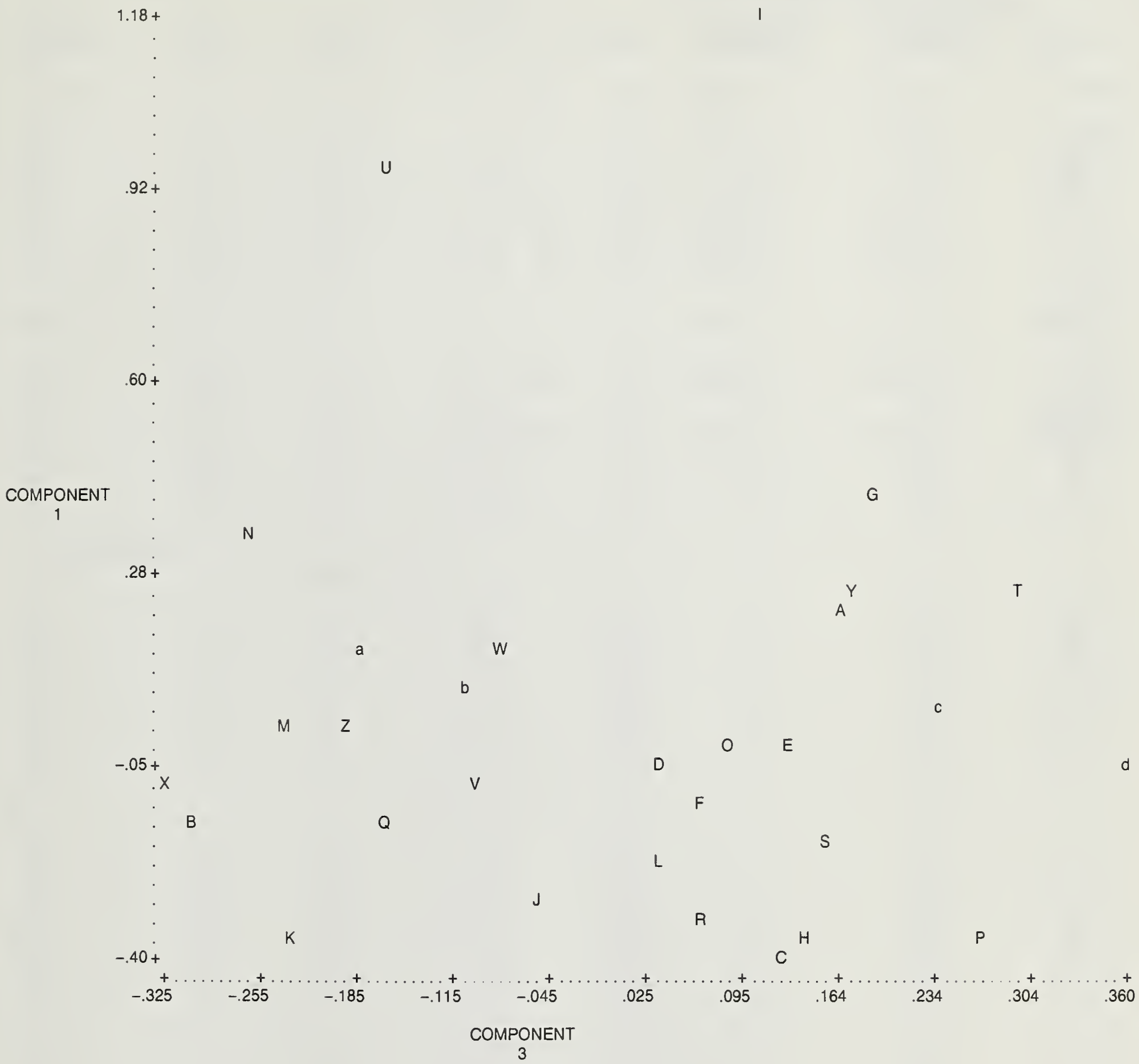
DISPLAY 17. PRINCIPAL COMPONENT ANALYSIS: SCATTERGRAM (LEGEND ON PREVIOUS PAGE)
OF COMPONENT SCORES



DISPLAY 17. PRINCIPAL COMPONENT ANALYSIS: LEGEND FOR SCATTERGRAM (NEXT PAGE) OF COMPONENT SCORES

STIMULUS	SYMBOL	COMPONENT 1	COMPONENT 3
1	A	.169	.161
2	B	–.173	–.315
3	C	–.403	.125
4	D	–.087	.022
6	E	–.060	.130
7	F	–.154	.057
8	G	.388	.198
9	H	–.384	.134
10	I	1.181	.100
11	J	–.316	–.069
12	K	–.371	–.238
14	L	–.227	.021
15	M	–.021	–.248
16	N	.298	–.266
18	O	–.047	.063
19	P	–.362	.259
20	Q	–.165	–.173
21	R	–.344	.055
22	S	–.216	.144
23	T	.220	.281
24	U	.908	–.164
25	V	–.110	–.106
26	W	.111	–.081
27	X	–.116	–.332
28	Y	.213	.166
29	Z	–.003	–.203
30	a	.124	–.195
31	b	.034	–.115
34	c	.003	.228
35	d	–.090	.360

DISPLAY 17. PRINCIPAL COMPONENT ANALYSIS: SCATTERGRAM (LEGEND ON PREVIOUS PAGE)
OF COMPONENT SCORES



DISPLAY 18. PRINCIPAL COMPONENT ANALYSIS: CORR. OF COMPONENT SCORES WITH OTHER MEASURES OF INTEREST

	COMPONENT 1	COMPONENT 2	COMPONENT 3
RATING	.981	.063	.080
MEDIAN	.912	.093	−.071
STD. DEV. RAT.	−.224	−.001	−.081
OAR	.981	.063	.080
SBE	.979	.056	.100
ALL STIM. Z-SCORE	.998	.001	.013
ALL STIM. LSR	.999	.022	.024
BL STIMULI Z-SCORE	.993	.018	−.011

CONDITION/ OBSERVER	MEAN RATING	MEDIAN RATING	STD. DEV. OF RATINGS	SBE	SKEWNESS RATING	KURTOSIS RATING	MOD. A-D RATING
					– INDICATIONS OF NORMALITY –		
ALL STIM.	4.87	4.7	1.74	-12.39	.51	-.068	1.228
OBS. 1	7.30	7.0	.88	30.12	.30	-.668	1.937
OBS. 2	4.93	4.5	1.89	-34.70	.39	-.250	.883
OBS. 4	5.80	5.5	1.61	9.17	.36	-.905	.859
OBS. 5	4.60	4.0	1.25	17.13	.86	.322	1.536
OBS. 6	2.93	3.0	1.60	-29.20	1.93	4.782	2.262
OBS. 7	4.90	4.5	2.43	-12.50	-.07	-1.206	.740
OBS. 8	5.40	6.0	2.70	-36.56	-.13	-1.423	.924
OBS. 10	3.90	4.0	1.32	-23.49	.35	-.801	1.221
OBS. 12	4.07	4.0	2.03	-31.49	.58	-.460	.694
BASELINE	5.11	5.0	1.82	.00	.53	-.681	.655
OBS. 1	7.11	7.0	.93	.00	.65	-.542	.844
OBS. 2	5.89	7.0	2.15	.00	-.01	-1.819	.652
OBS. 4	5.78	6.0	1.64	.00	.31	-.388	.490
OBS. 5	4.00	4.0	1.00	.00	.67	-.778	.699
OBS. 6	3.22	3.0	2.22	.00	1.87	2.105	1.957
OBS. 7	4.89	4.0	2.37	.00	.52	-1.316	.399
OBS. 8	6.33	6.0	2.18	.00	.07	-1.263	.173
OBS. 10	4.11	4.0	1.54	.00	.39	-1.087	.452
OBS. 12	4.67	4.0	2.40	.00	.30	-1.044	.225
ALL NON-BASELINE STIMUL	4.77	4.6	1.69	-17.47	.31	-.694	.971
OBS. 1	7.38	7.0	.86	26.14	.13	-.796	1.334
OBS. 2	4.52	4.0	1.66	-57.23	.36	.913	.780
OBS. 4	5.81	5.0	1.63	7.28	.36	-1.339	1.024
OBS. 5	4.86	5.0	1.28	29.08	.80	.035	1.306
OBS. 6	2.81	3.0	1.29	-35.46	.60	-.114	.809
OBS. 7	4.90	5.0	2.51	-12.63	-.28	-1.325	.864
OBS. 8	5.00	5.0	2.85	-50.79	.00	-1.715	1.064
OBS. 10	3.81	4.0	1.25	-23.90	.20	-1.219	.897
OBS. 12	3.81	3.0	1.86	-39.72	.57	-.687	.663
MIXPRE	4.71	4.3	1.76	-14.93	.51	-.783	.751
OBS. 1	7.33	7.0	.89	12.77	.11	-1.001	.746
OBS. 2	4.08	4.0	2.02	-66.50	.87	.551	.733
OBS. 4	5.83	5.0	1.75	5.28	.51	-1.378	.772
OBS. 5	4.67	4.0	1.50	24.25	.97	-.190	1.007
OBS. 6	2.83	2.5	1.64	-20.60	.47	-1.148	.460
OBS. 7	6.00	6.5	1.76	36.14	-.28	-1.552	.549
OBS. 8	4.67	3.5	3.03	-55.22	.36	-1.706	.848
OBS. 10	3.75	3.0	1.42	-15.85	.40	-1.442	.824
OBS. 12	3.25	3.0	1.86	-54.65	1.21	.821	.820
MIXPOST	4.84	5.1	1.44	-10.74	.03	-1.340	.689
OBS. 1	7.44	7.0	.88	12.01	.15	-1.044	.588
OBS. 2	5.11	5.0	.78	-27.83	-.15	-1.536	.750
OBS. 4	5.78	6.0	1.56	-1.86	-.03	-1.858	.622
OBS. 5	5.11	5.0	.93	39.10	.65	-.542	.844
OBS. 6	2.78	3.0	.67	-17.54	.18	-1.120	1.008
OBS. 7	3.44	4.0	2.70	-51.26	.46	-1.461	.775
OBS. 8	5.44	7.0	2.70	-34.82	-.56	-1.595	.813
OBS. 10	3.89	4.0	1.05	-8.30	-.38	-1.330	.518
OBS. 12	4.56	5.0	1.67	-6.15	-.09	-1.575	.279

APPENDIX D

SAMPLE SAVE OUTPUT FILE: SAMPLE.SAV

DISPLAY 4. N STIMULI = 30 06–07–90 13:49:47

STIMULUS	CONDITION	MEAN	MEDIAN	STD DEV	OAR: ALL	Z:ALL	LSR:ALL	OAR:BL	Z:BL	LSR:BL	SBE	SBE*	SKW:RAW	SKW:Z	KURTOSIS	MOD. A-D
1	BASELINE	5.67	6.00	1.66	.80	.32	5.11	.56	.24	5.39	18.62	36.369	–.260	.077	–1.501	.454
2	BASELINE	4.11	4.00	1.90	–.76	–.32	4.64	–1.00	–.36	4.67	–36.00	–70.312	–.140	.011	–1.307	.179
3	BASELINE	3.78	3.00	1.09	–1.09	–.73	4.40	–1.33	–.81	4.13	–45.08	–88.028	.891	–.238	–.784	1.066
4	BASELINE	4.67	5.00	2.29	–.20	–.17	4.78	–.44	–.24	4.79	–15.35	–29.968	.142	.279	–1.793	.466
6	BASELINE	4.78	4.00	1.79	–.09	–.12	4.81	–.33	–.19	4.87	–10.12	–19.770	.295	.732	–1.869	.813
7	BASELINE	4.33	4.00	1.41	–.54	–.31	4.68	–.78	–.38	4.68	–25.84	–50.466	.655	.188	–1.111	.598
8	BASELINE	6.22	7.00	2.22	1.35	.71	5.36	1.11	.59	5.85	37.42	73.070	–.550	–.071	–1.070	.312
9	BASELINE	4.00	4.00	1.58	–.87	–.67	4.43	–1.11	–.70	4.27	–39.22	–76.599	.000	–.059	–1.791	.418
10	BASELINE	8.44	9.00	1.24	3.57	2.07	6.31	3.33	1.85	7.36	115.57	225.704	–.770	1.066	–.790	.930
11	MIXPRE	4.22	4.00	2.39	–.65	–.52	4.52	–.89	–.53	4.42	–30.92	–60.382	.552	.748	–.710	.272
12	MIXPRE	3.67	4.00	1.80	–1.20	–.67		–1.44	–.68	4.28	–50.30	–98.240	–.013	.272	–1.647	.297
14	MIXPRE	4.22	4.00	1.48	–.65	–.40	4.60	–.89	–.44	4.58	–31.85	–62.204	.280	–.215	–.935	.341
15	MIXPRE	5.00	5.00	2.50	.13	.03	4.85	–.11	.05	5.15	–6.62	–12.931	–.341	–.395	–1.629	.478
16	MIXPRE	5.33	6.00	2.29	.46	.45	5.19	.22	.30	5.51	6.17	12.059	–.308	–.263	–1.551	.375
18	MIXPRE	4.56	4.00	1.59	–.31	–.10	4.80	–.56	–.21	4.90	–17.98	–35.111	.988	.289	–.266	.774
19	MIXPRE	3.89	4.00	2.32	–.98	–.63	4.44	–1.22	–.71	4.30	–40.63	–79.354	.549	.805	–1.163	.495
20	MIXPRE	4.33	3.00	2.06	–.54	–.24	4.65	–.78	–.24	4.80	–23.79	–46.456	.440	.887	–1.807	1.124
21	MIXPRE	4.00	4.00	2.40	–.87	–.55	4.46	–1.11	–.57	4.47	–38.29	–74.777	.290	.347	–1.313	.318
22	MIXPRE	4.11	4.00	1.83	–.76	–.38	4.60	–1.00	–.43	4.64	–36.00	–70.298	.722	.215	–.332	.492
23	MIXPRE	5.56	5.00	2.60	.69	.39	5.14	.44	.33	5.55	17.90	34.955	.171	–.168	–1.714	.378
24	MIXPRE	7.67	8.00	1.32	2.80	1.64	5.97	2.56	1.54	6.94	88.97	173.747	–.896	.242	–.654	1.099
25	MIXPOST	4.44	4.00	2.19	–.43	–.20	4.73	–.67	–.22	4.78	–24.00	–46.863	–.189	–.033	–1.647	.356
26	MIXPOST	5.00	4.00	1.87	.13	.13	4.99	–.11	.03	5.18	–2.26	–4.415	.407	.564	–1.658	.642
27	MIXPOST	4.00	5.00	2.35	–.87	–.31	4.69	–1.11	–.39	4.64	–39.86	–77.841	–.052	–.248	–1.736	.469
28	MIXPOST	5.78	5.00	2.05	.91	.44	5.15	.67	.41	5.62	22.97	44.858	–.123	–.396	–1.765	.629
29	MIXPOST	4.67	5.00	2.40	–.20	.02	4.84	–.44	.05	5.12	–16.28	–31.790	–.086	.285	–1.582	.243
30	MIXPOST	5.44	6.00	1.33	.57	.23	5.04	.33	.17	5.29	11.25	21.975	–.457	–1.291	–1.167	.394
31	MIXPOST	4.89	5.00	2.09	.02	.04	4.91	–.22	–.02	5.07	–10.28	–20.078	–.749	–.712	–1.007	.711
34	MIXPOST	5.00	4.00	1.87	.13	.04	4.89	–.11	–.03	5.09	.96	1.884	.713	.013	–1.331	1.205
35	MIXPOST	4.33	4.00	2.18	–.54	–.19	4.74	–.78	–.30	4.81	–26.77	–52.274	.844	.556	–.318	.494

Brown, Thomas C.; Daniel, Terry C.; Schroeder, Herbert W.; Brink, Glen E. 1990. An analysis of ratings: a guide to RMRATE. Gen. Tech. Rep. RM-195. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 40 p.

This report describes RMRATE, a computer program for analyzing rating judgments. RMRATE scales ratings using several scaling procedures, and compares the resulting scale values. The scaling procedures include the median and simple mean, standardized values, scale values based on Thurstone's Law of Categorical Judgment, and regression-based values. RMRATE also computes reliability statistics and analyzes the ratings using principal component analysis techniques to assess variation among judges. RMRATE should be useful to practitioners needing to summarize or analyze rating data, and to researchers interested in comparing and evaluating alternative scaling methods.

Keywords: Ratings, psychological scaling, reliability, judgment scaling model

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Rocky
Mountains

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Great
Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

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Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

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